GEOGRAPHIC VARIATION IN SURGICAL FEES

Final Report

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Janet B. Mitchell, Ph.D.
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May 1989

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ABSTRACT

Large variations in Medicare physicians' fees have been observed across states, as well as across smaller localities, like cities and urban-rural areas within states. Surgical fees are particularly interesting in this regard because inter-area differences in the definition of the product are less likely to contribute to the variation. This paper examines the variation in surgical fees across market areas, looking specifically at the roles played by physician practice costs, the use of assistant surgeons, and extra billing by the primary surgeon. Results showed that, although taking physician practice costs into account did narrow the fee gap, considerable variation remained, especially when comparing MSAs across states. On the other hand, urban-rural differences in surgeons' allowed charges tended to be relatively small, and after adjusting for differences in the practice costs, they often disappeared. Including charges for pre- and post-operative visits had no effect on the fee gap because surgeons apparently do little, if any, extra billing for follow-up care. One explanation for the persisting variations in surgeons' fees may be area differences in the market factors that influence the demand and supply of surgical operations. Since areas with relatively high fee levels for one kind of surgery often had low fees for other operations, however, if market forces are important, they may be unique to each surgical procedure.

INTRODUCTION

Tremendous variation in Medicare physicians' fees has been observed both across large geographic areas like states, as well as across smaller localities, like cities and urban-rural areas within states.[1] Although fee variation has been documented for all types of physician services, variation in surgical fees is particularly interesting because inter-area differences in the definition of the product are less likely to be a contributing factor. Perceptions of (and hence bills for) what constitutes an inguinal hernia repair, for example, are apt to be more homogeneous than what is meant by an intermediate office visit. Surgical fees are also of interest because Congress and the Department of Health and Human Services have recently questioned the "inherent reasonableness" of what Medicare is paying for many surgical operations. As part of the Omnibus Budget Reconciliation Act of 1987, Congress imposed reductions in prevailing charges for eleven surgical procedures believed to be "overpaid", and developed a complex formula that would reduce payments disproportionately more in high fee areas. In the same act, Congress also mandated bonus payments of five percent for all services provided in rural shortage areas. Two rural health bills now pending in the House and Senate would narrow further the fee differential between urban and rural physicians, in part by increasing the bonus payments to 10 percent.

While it is certainly reasonable for a major payor to raise these concerns, the geographic variation in surgical fees may not be entirely arbitrary. Instead, at least some of it may be explained by differences in the costs of physician practice across areas, the mix of services encompassed within global surgical fees, or the involvement of other surgeons during the operation. For example, fees may be higher where office rents, nursing wages, and malpractice premiums are also higher. Or higher fees in an area might be offset by fewer bills for postoperative surgical visits and fewer bills from assistant surgeons. Where these conditions are found, simple comparisons of fees for the surgery alone would overstate the extent of "true" variation.

This paper seeks to examine the variation in surgical fees across market areas, looking specifically at the roles played by physician practice costs, the use of assistant surgeons, and extra-billing by the primary surgeon. The principal question being asked is: To what extent do these factors reduce the "charge differential" across areas?

STUDY METHODS

This study draws upon a unique data base: the universe of Medicare physician claims from 10 states. While national Medicare claims data are available from the Health Care Financing Administration, they are based on five percent samples of beneficiaries and providers and do not contain sufficient numbers of surgical operations for analysis at the level of individual MSAs and rural areas. In order to obtain sufficient sample sizes and to obtain a reliable picture of complete surgical activity within a market area, we selected ten states for indepth study: Alabama, Arizona, Connecticut, Georgia, Kansas, New Jersey, Oklahoma, Oregon, Washington, and Wisconsin. These states were chosen to represent the nine census divisions and a range of urban and rural areas. Together they accounted for 18 percent of all Medicare eligibles in the U.S.

Six operations were chosen for study and are shown in Table 1 along with the total number of cases across all 10 states. If fewer than 50 procedures were performed in a given market area, that market area was dropped from the study. The actual number of market areas is also shown in Table 1. (The 10 states included a total of 71 MSAs and 10 rural areas.) The six procedures were chosen because they represent three types of surgery (cardiovascular, orthopedic, and general) and either were high-volume Medicare operations or had been identified by Congress as overpaid. Each procedure was assigned to an MSA or a rural area based on the location of the surgeon's practice. The address of each surgeon was obtained from the Provider Directories maintained by the Medicare carriers. This is one of the first studies of fee variation that places a physician's practice in an area as small as an MSA and

that permits comparisons among urban areas and between urban and rural areas. Previous work with Medicare data has used the Reasonable Charge Locality which, in many cases, is an entire state.[2]

The pre- and postoperative period encompassed by the global surgical fee varies by carrier and by surgical procedure. In order to standardize comparisons across the geographic areas, we defined this period as seven days prior to and 90 days following surgery, a time consistent with actual practice in many areas. (Our results were not sensitive to changes in the actual definition used for reasons that will be seen below.) We obtained all Medicare physician bills submitted during this period for each patient with one of these six procedures.

It is reasonable for physicians, like other economically rational providers of services, to set their fees higher when their practice costs are also relatively higher. We used the Geographic Practice Cost Index (GPCI) developed by Zuckerman et al.,[3] as a measure of physicians' relative costs to determine the extent to which Medicare allowed charges reflected variations in physicians' costs of practice.

The GPCI was created for the same MSAs and rural areas used in this study. It reflects geographic variation in costs for four broad input categories -- physician time, employee time, office rent and malpractice insurance -- which together account for 87 percent of total practice revenues. Because geographic data for the remaining three input categories (medical supplies, medical equipment, and other) were not available, costs for these inputs were assumed to be the same in all areas.

RESULTS

Variation in Allowed Charges Across MSAs

Average allowed charges for the six surgical procedures are shown in Table 2. Two sets of charges are presented for each procedure: the mean actual allowed charge and the mean charge, adjusting by the Geographic Practice Cost Index. We concentrate first on actual charges.

The all-area mean is based on allowed charges from all MSAs and rural areas, not just those actually presented in the table. For ease of presentation, we have displayed only the largest MSA in each state. Since these MSAs share similar characteristics (they are all large cities with major medical centers and high surgeon-population ratios), we might expect fees to be fairly comparable. While the range in surgeons' fees across areas is, in fact, narrowed somewhat when we compare major MSAs only, substantial variation still remains. Based on all areas performing CABG surgery, for example, allowed charges are 93 percent higher in Newark (the highest charge area in our analysis) than in Macon, Georgia (the lowest charge area), as indicated by the ratio at the bottom of the column. When we restrict our comparisons to the 10 large MSAs, the range is still 81 percent, i.e. $5,394 in Newark versus $2,985 in Birmingham. (While Newark appears to be an outlier among these ten cities, its allowed charges are similar to those in other large cities in the region.)

All six procedures shown on Table 2 show wide variation in surgeons' charges, even across the 10 MSAs. It is interesting to note, however, that areas with high charges for one type of surgery do not necessarily have high charges for other procedures. While Birmingham thoracic surgeons receive considerably less for CABG surgery than do their colleagues elsewhere, for example, orthopedic surgeons in Birmingham are paid substantially more for hip replacements relative to surgeons in other MSAs.

While the fee differential ranges from 60-90 percent for five of the procedures, allowed charges for pacemaker insertion vary by a factor of almost 2 1/2. Physicians in Portland and Milwaukee are reimbursed only a fraction of what their colleagues in other areas receive. This appears to be due partly to differences in the use of the "team" approach to pacemaker insertion. Under the team approach, a surgeon makes the "pocket" to hold the device and a cardiologist threads the electrodes. The problem arises in deciding how to pay for the operation. Neither physician is serving as an assistant surgeon; each is performing a portion of the procedure. Although carriers have developed different ways of identifying and paying for this procedure, the

data shown here (and that used in all analyses we have seen) are based on a single physican's charge only. The other team member often bills under a different procedure code, a practice that can grossly understate the "true" (i.e. total) charge for pacemaker insertion. We examine the impact of these team bills below.

The effect of the practice cost adjustment is generally to narrow the fee differential across areas, as seen by comparing the two columns for each procedure. The one exception is for total hip replacements, where the geographic disparity is actually increased after we take into account practice cost differences. The reasons for this are the high absolute charges in Birmingham (and, to a lesser extent, Atlanta) and the relatively low practice costs in those two cities.

Nevertheless, substantial fee variation remains for all procedures. Even after taking into account area differences in wages, office rents, and malpractice premiums, the average bill for a CABG operation in Newark is about $1,400 higher than a bill for comparable surgery in Birmingham.

But are fees for the two surgeries truly comparable? It is possible that charges are lower in some MSAs because they represent a less comprehensive package of services. All surgical fees are global fees, that is, they are intended to cover the operation itself and some amount of pre- and postoperative care, but the extent of follow-up care included in the global fee may vary from one geographic area to another. We examine this below.

Variation in Pre- and Postoperative Visits

Table 3 compares the number of pre- and postoperative visits billed by the surgeon performing the operation. Because the follow-up period encompassed by the global fee may vary across areas, we used a standard time period for all of our surgical procedures and all areas: from seven days prior to surgery to 90 days following. Visits were defined broadly to include office, hospital, and ICU visits, as well as consultations. In the case of pacemakers inserted using the team approach, we include visits provided by either of the two physicians involved.

As a rule, bills for visits or consultations were rarely submitted by surgeons in any market area, suggesting that most surgeons share a common definition of the global fee. When bills were submitted, they were generally for a preoperative consultation in the hospital. The dollars involved thus are relatively small, particularly when compared to the charge for the operation itself.

Billing was fairly frequent in the case of pacemaker insertions, however, particularly in areas like Milwaukee and Portland, where fee levels for the operation are relatively low. Given that a fee represented by a single bill does not always reflect the "true" charge when a team approach is employed, however, these low fees may be misleading. To what extent can the inter-area variation in pacemaker fees be reduced if we account for team bills and for extra-billing by all physicians involved in the insertion procedure? Adding in team physician billings has a dramatic impact on the fee differential for some areas, but not for others, as seen in Table 4, leaving the range in charges virtually unchanged. The average charge in Milwaukee increases 55 percent (from $591 to $916), but that in Portland goes up only modestly. Adding in pre- and postoperative visit bills from the primary surgeon (or team members), however, narrows the charge "gap" considerably. The average charge in Newark is now "only" 76 percent greater than in Portland, compared with 105 percent before any adjustments were made.

Variation in the Use of Assistant Surgeons

As a rule, Medicare pays the primary surgeon who performed the operation without regard to any help that surgeon might have received from assistants, yet an "extra pair of hands" may enhance the surgeon's productivity by shortening operating room time. The use of assistants raises the total cost of surgery to the patient and to the Medicare Part B program, however, as an additional bill is submitted (unless a resident assists, in which case the costs are borne by Part A). This bill is generally paid at 20 percent of the primary surgeon's charge.

As shown in Table 5, there is as much or more variation in the use of fee-for-service (non-resident) assistant surgeons as there is in the fees themselves.* The use of assistant surgeons during hip fracture surgery, for example, ranged from five percent of the operations in Hartford and Oklahoma City to 40 percent in Seattle. The more complex hip replacements exhibited even greater variability in assistant surgeon billings. The availability of orthopedic residency programs may be a factor, but of our ten MSAs, surgeons in Hartford used assistants least even though it was the only MSA not to have such a program. Other possible explanations may lie in the resident-to-operation workload, the availability of fee-for-service orthopedic surgeons, and surgeons' preferences to "go it alone".

Factoring in the additional costs associated with assistant surgeons raises the total cost of surgery in some MSAs relative to others. The fee differential is generally unaffected, however.

Urban and Rural Differences in Surgeons' Fees

The preceding tables have illustrated the considerable geographic disparities in surgical payments across large MSAs. The urban-rural fee differential has been an even greater source of concern to many policymakers, and, as a result, Congress mandated a five percent payment bonus to all physicians practicing in rural shortage areas beginning in January 1989. Our analyses suggest, however, that at least for surgical fees, urban-rural differences tend to be much smaller than those across states. Table 6 compares Medicare allowed charges for urban and rural areas in each of nine states (New Jersey was omitted as it has no rural areas). We show results here for cholecystectomy, as this operation (unlike some of the others under study) is commonly performed by both urban and rural surgeons.

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*We do not show pacemaker insertions here, as an assistant surgeon is generally not needed. The team approach to pacemaker insertion, in which two physicans may be actively involved, was described earlier.

Urban surgeons do appear to enjoy higher allowed charges for cholecystectomy than do their rural colleagues, but the differences are often small (less than five percent in four of the states). Moreover, after adjustment for geographic differences in practice costs (col. 2), the fee differential either narrows substantially (in the case of Alabama, Arizona, Georgia, Oklahoma, and Oregon), or reverses. That is, once we take into account the lower costs of living in, and practicing in, rural Connecticut, Kansas, Washington, and Wisconsin, surgeons in those areas enjoy fees for cholecystectomy that are substantially higher in real terms than those in urban areas.

The practice cost adjustment shown in column 2 of Table 6 (and in previous tables) takes into account not only area differences in office rents, supply costs, nursing wages, and the like, but also differences in professional salaries (the latter proxying for area differences in the value of physicians' time). However, some policymakers (including the Physician Payment Review Commission) have argued that the physician's time should be valued equally across the country and that any geographic practice cost adjustments should be based on overhead costs only.[4] Therefore, we also adjusted surgical fees using an overhead-only index. The net effect is to increase urban fees somewhat relative to rural fees, compared with a total practice cost adjustment, but the urban-rural differential remains much smaller than in the absence of any adjustment.

Impact of the 1987 OBRA "Overpriced Procedure" Roll-Backs

As part of the Omnibus Budget Reconciliation Act (OBRA) of 1987, Congress reduced Medicare prevailing charges for eleven surgical procedures that were believed to be "overpaid". Three of the eleven procedures have been presented in this paper: total hip replacement, CABG surgery, and pacemaker insertion. The formula used to reduce payments was constructed in such a way as to "roll back" charges disproportionately more in high fee areas. It is thus possible that the geographic fee variation we observed based on our 1986

data has been considerably reduced. (The roll-backs went into effect April, 1988.) In order to test this possibility, we simulated 1988 allowed charges that incorporated the impact of the payment reductions.*

By comparing the ratios of highest to lowest charge areas (Table 7), we see that the OBRA-87 payment reductions narrowed the fee differential only slightly. Considerable variation remains primarily because the actual reductions tended to be relatively small; the average hip replacement fee was reduced by 2.7 percent, for example. Nevertheless, since the reductions were concentrated among high charge areas (as intended by Congress), we do observe some compression in the range of charges.

Because the sliding scale formula imposed by Congress ignored practice cost differences, however, surgeons in high cost-of-practice areas appear to have been penalized disproportionately. Orthopedic surgeons in Hartford and Newark averaged roll-backs of four percent or more, for example. If their prevailing charge screens had been adjusted by the Geographic Practice Cost Index before applying the formula, however, their reductions would have been minimal. By contrast, surgeons practicing in low cost-of-practice areas, like Kansas City and Oklahoma City, would have faced greater roll-backs if the formula had incorporated practice cost adjustments.

Finally, the team approach to pacemaker insertion introduces additional inequities in how the roll-backs have been implemented. Because the prevailing charge screens are applied to single bills, rather than to the <u>total</u> charge for pacemaker insertion, team physicians effectively avoid the overpriced procedure reductions.

CONCLUSIONS

Our results confirm the considerable variation in surgical fees across small geographic areas. Unlike other studies, however, we sought to reduce

*This was done by updating 1986 allowed charges by the Medicare Economic Index, calculating the new reduced 1988 prevailing charges based on the Congressional formula, and then determining the effective 1988 allowed charges based on each surgeon's participation status. The simulation methodology is described in detail in Mitchell <u>et al</u>.[5]

the fee "gap" by adjusting for differences in the costs of physician practice. Although this adjustment did narrow the gap, considerable variation remains, especially across MSAs in different states. Urban-rural fee differences tended to be quite small, even before the cost of practice adjustment. These results suggest that special bonus payments for surgeons practising in rural areas (as opposed to primary care physicians) may not be necessary, or even appropriate if the goal of such a policy is to promote equity among physicians. (We did not, however, specifically examine relative fee levels in shortage areas.)

Accounting for the mix of pre- and postoperative visits encompassed in the global surgical fee had no effect on the fee "gap". This is probably due largely to the fact that there is little, if any, extra billing by the surgeon for follow-up care. This is reassuring for policymakers who had feared that such "unbundling" was wide-spread. It is possible, however, that surgeons may begin to unbundle in response to drastically lowered surgical fees (as could occur under a Resource-Based Relative Value Scale).

How can we explain wide-spread geographic surgical fee variation that persists, even after adjusting for practice cost differences? One explanation may be area differences in market factors that influence the demand and supply of surgical operations, a subject for future study. We failed to find any consistent patterns across surgical procedures, however, i.e. areas with relatively high fee levels for one kind of surgery had low fees for other surgeries. This suggests that, if market forces are important, they may be unique to each surgical procedure.

REFERENCES

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TABLE 1

STUDY PROCEDURES

	Number of Operations	Number of Market Areas
Cardiovascular		
Coronary Artery Bypass Graft Surgery	16,235	36
Permanent Pacemaker Insertion	10,287	48
Orthopedic		
Hip Fracture Repair	24,935	76
Total Hip Replacement	11,699	52
General		
Cholecystectomy	23,378	70
Partial Colectomy	11,050	58

Source: Medicare Part B claims, 1986.

TABLE 2

AVERAGE MEDICARE ALLOWED CHARGES BY MSA: ACTUAL VERSUS ADJUSTED FOR PRACTICE COSTS

	CABG Surgery		Pacemaker Insertion		Hip Fracture Repair		Hip Replacement		Cholecystectomy		Partial Colectomy	
	Actual	Adjusted	Actual	Adjusted	Actual	Adjusted	Actual	Adjusted	Actual	Adjusted	Actual	Adjusted
Atlanta, GA	$3,085	$3,270	$1,133	$1,201	$1,287	$1,364	$2,331	$2,471	$870	$920	$1,110	$1,177
Birmingham, AL	2,985	3,260	1,012	1,106	1,184	1,294	2,508	2,739	850	929	1,185	1,293
Hartford, CT	4,238	4,031	1,058	1,006	1,177	1,119	2,417	2,299	921	876	1,195	1,137
Kansas City, KS	3,086	3,249	1,057	1,113	1,191	1,254	2,092	2,203	831	875	1,071	1,128
Milwaukee, WI	4,150	4,143	592	591	1,153	1,151	1,724	1,721	812	811	1,173	1,171
Newark, NJ	5,394	4,658	1,388	1,199	1,524	1,316	2,378	2,051	1,064	919	1,454	1,256
Oklahoma City, OK	3,744	4,193	959	1,074	1,065	1,193	1,915	2,145	836	937	1,025	1,148
Phoenix, AZ	3,810	3,703	1,177	1,144	1,295	1,259	2,491	2,422	1,032	1,003	1,294	1,258
Portland, OR	3,700	3,711	585	586	1,204	1,207	2,215	2,222	822	884	1,058	1,061
Seattle, WA	4,088	3,834	865	811	1,197	1,123	2,225	2,087	802	752	1,178	1,105
All Areas	3,682	3,764	996	1,037	1,156	1,191	2,199	2,299	856	879	1,148	1,168
Ratio of Highest to Lowest Charge Areas	1.93	1.46	2.44	2.14	1.77	1.52	1.59	1.66	1.88	1.53	1.70	1.35

Source: Medicare Part B Claims, 1986.

TABLE 3

MEAN NUMBER OF VISITS BILLED DURING A STANDARD GLOBAL FEE PERIOD[a]

MSA	CABG	Pacemaker Insertion[b]	Hip Fracture Repair	Hip Replacement	Cholecystectomy	Colectomy
Atlanta, GA	1.04	2.32	1.13	0.95	1.50	1.45
Birmingham, AL	0.08	1.09	0.87	0.75	0.28	1.32
Hartford, CT	0.80	1.82	1.06	1.54	2.18	2.91
Kansas City, KS	0.08	1.25	0.30	0.44	0.36	0.75
Milwaukee, WI	0.03	3.40	0.79	0.57	1.22	1.16
Newark, NJ	0.69	2.88	1.90	1.60	1.32	2.07
Oklahoma City, OK	0.42	3.18	0.47	0.72	0.96	1.12
Phoenix, AZ	0.89	2.17	1.13	1.05	1.39	1.69
Portland, OR	0.14	4.98	0.64	0.53	0.70	0.55
Seattle, WA	0.53	2.97	0.68	1.01	0.67	0.90

[a]The global fee period includes 7 days prior to surgery, and 90 days following.

[b]Includes visits by team physicians.

Source: Medicare Part B Claims, 1986.

TABLE 4

ADJUSTING PACEMAKER INSERTION FEES FOR A TEAM APPROACH AND FOR EXTRA-BILLING[a]

	Surgeon's Fee Only[b]	Team Approach	Pre/Post Operative Visits
Atlanta, GA	$1,201	$1,214	$1,335
Birmingham, AL	1,106	1,107	1,151
Hartford, CT	1,006	1,027	1,109
Kansas City, KS	1,113	1,133	1,190
Milwaukee, WI	591	916	1,036
Newark, NJ	1,199	1,294	1,419
Oklahoma City, OK	1,074	1,084	1,197
Phoenix, AZ	1,144	1,177	1,284
Portland, OR	586	636	806
Seattle, WA	811	858	952
Ratio of Highest to Lowest Charge MSA[c]	2.05	2.03	1.76

[a]All charges have been adjusted by the Geographic Practice Cost Index.

[b]The charges in this column is identical to the adjusted column in Table 1.

[c]Based on the MSAs shown only.

Source: Medicare Part B claims, 1980.

TABLE 5

PERCENT OF CASES WITH AN ASSISTANT SURGEON BY MSA

MSA	CABG	Hip Fracture Repair	Hip Replacement	Cholecystectomy	Colectomy
Atlanta, GA	32.5%	6.6%	30.4%	47.8%	36.4%
Birmingham, AL	28.6	13.0	39.1	42.0	54.9
Hartford, CT	93.1	5.0	21.5	21.6	20.1
Kansas City, KS	86.4	8.7	39.8	40.8	33.6
Milwaukee, WI	10.6	19.3	27.6	33.0	32.8
Newark, NJ	31.0	36.5	55.1	39.9	33.9
Oklahoma City, OK	86.6	5.2	28.5	64.6	47.0
Phoenix, AZ	51.9	29.5	43.4	34.4	38.7
Portland, OR	73.7	34.1	74.8	50.9	46.4
Seattle, WA	65.0	41.2	63.7	65.8	63.8

Source: Medicare Part B Claims, 1986.

TABLE 6

MEDICARE ALLOWED CHARGES FOR CHOLECYSTECTOMY IN URBAN AND RURAL AREAS: ACTUAL VERSUS ADJUSTED FOR PRACTICE COSTS[a]

	Actual	Adjusted for Total Practice Costs	Adjusted For Overhead Costs Only
Alabama			
Urban	$800	$889	$840
Rural	768	888	833
Arizona			
Urban	1,013	995	993
Rural	912	967	931
Connecticut			
Urban	966	890	921
Rural	961	983	953
Georgia			
Urban	848	933	871
Rural	766	934	833
Kansas			
Urban	803	856	811
Rural	745	922	801
Oklahoma			
Urban	847	942	883
Rural	781	933	856
Oregon			
Urban	849	875	843
Rural	805	864	815
Washington			
Urban	806	774	798
Rural	797	833	803
Wisconsin			
Urban	782	822	805
Rural	762	896	814

[a]New Jersey is excluded here, as it includes no rural counties.

Source: Medicare Part B claims, 1986.

TABLE 7

COMPARISONS OF AVERAGE ALLOWED CHARGES BEFORE AND AFTER OBRA-87 PAYMENT REDUCTIONS

	1986	1988 (simulated)
Total Hip Replacement		
Range	$1,623-$2,508	$1,717-$2,589
Ratio of Highest to Lowest Charge Area	1.59	1.51
Pacemaker Insertion		
Range	$585-$1,430	$576-$1,382
Ratio of Highest to Lowest Charge Area	2.44	2.40
CABG Surgery[a]		
Range	$2,790-$4,285	$2,879-$4,261
Ratio of Highest to Lowest Charge Area	1.53	1.48

[a]New Jersey is excluded here, as the carrier developed state-wide prevailing charges in 1987 that were substantially below 1986 reimbursement levels. As a result, the OBRA-87 impacts would be over-stated for New Jersey.

Source: Medicare Part B claims, 1986.

TABLE A-1

MEAN MEDICARE ALLOWED CHARGES BY MARKET AREA FOR CORONARY ARTERY BYPASS GRAFT SURGERY, 1986[a]

Area	n	Actual	ADJUSTED FOR GEOGRAPHIC PRACTICE COST DIFFERENCES: Total Practice Costs	Overhead Costs Only
Alabama				
Tuscaloosa	154	$2,960	$3,424	$3,107
Birmingham	1,484	2,985	3,260	3,120
Dothan	171	2,790	3,196	2,945
Huntsville	155	3,434	3,689	3,609
Mobile	235	2,914	3,319	3,049
Montgomery	134	3,112	3,439	3,270
Arizona				
Phoenix	894	3,810	3,703	3,725
Tucson	295	3,993	4,061	3,946
Connecticut				
Bridgeport	212	4,139	3,455	3,851
Hartford	593	4,238	4,031	4,101
New Haven	523	4,285	4,199	4,122
Georgia				
Atlanta	1,247	3,085	3,270	3,094
Columbia-Richland	249	3,203	3,654	3,395
Columbus	66	3,103	3,726	3,328
Macon	149	2,787	3,248	2,932
Savannah	230	3,198	3,646	3,361
Kansas				
Kansas City	752	3,086	3,249	3,095
Topeka	152	3,087	3,521	3,201
Wichita	464	3,112	3,363	3,189
New Jersey				
Passaic-Bergen	645	4,901	4,253	4,513
Middlesex-Somerset	106	4,357	3,741	4,050
Newark	553	5,394	4,658	5,128
Philadelphia	508	4,839	4,403	4,575
Trenton	65	4,552	4,050	4,325

TABLE A-1 (continued)

MEAN MEDICARE ALLOWED CHARGES BY MARKET AREA FOR CORONARY ARTERY BYPASS GRAFT SURGERY, 1986[a]

Area	n	Actual	ADJUSTED FOR GEOGRAPHIC PRACTICE COST DIFFERENCES: Total Practice Costs	ADJUSTED FOR GEOGRAPHIC PRACTICE COST DIFFERENCES: Overhead Costs Only
Oklahoma				
Oklahoma City	665	$3,744	$4,193	$3,902
Tulsa	522	3,865	4,205	4,015
Oregon				
Portland	495	3,700	3,711	3,656
Eugene	151	3,464	3,707	3,447
Medford	168	3,274	3,476	3,278
Washington				
Seattle	1,039	4,088	3,834	3,988
Spokane	502	4,135	4,241	4,186
Tacoma	329	3,807	3,652	3,810
Wisconsin				
Appleton-Oshkosh	221	3,646	3,937	3,828
Milwaukee	1,145	4,150	4,143	4,213
Madison	189	3,677	3,849	3,806
Green Bay	773	3,626	3,981	3,780
All Areas	16,235	3,682	3,764	3,693
Ratio of Highest to Lowest Charge Areas		1.93	1.46	1.75

[a]Weighted means have been calculated across six CABG codes (based on the number of bypass grafts inserted), using national frequencies as weights.

Source: Medicare Part B Claims, 1986.

TABLE A-2

MEAN MEDICARE ALLOWED CHARGES FOR PACEMAKER INSERTION BY MARKET AREA, 1986[a]

			ADJUSTED FOR GEOGRAPHIC PRACTICE COST DIFFERENCES	
Area	n	Actual	Total Practice Costs	Overhead Costs Only
Alabama				
Birmingham	429	$1,012	$1,106	$1,058
Florence	56	1,026	1,099	1,088
Mobile	145	981	1,118	1,027
Montgomery	105	1,119	1,237	1,176
Rural	144	946	1,039	1,025
Arizona				
Phoenix	488	1,177	1,144	1,151
Tucson	152	1,131	1,150	1,117
Rural	53	1,041	1,103	1,062
Connecticut				
Bridgeport	87	961	802	894
Stamford	79	784	655	730
Hartford	241	1,058	1,006	1,024
New Haven	120	1,012	991	973
Waterbury	67	1,033	1,013	994
Rural	56	1,066	1,090	1,057
Georgia				
Atlanta	492	1,133	1,201	1,137
Columbia-Richland	262	1,074	1,226	1,139
Albany	56	1,126	1,253	1,195
Columbus	59	1,007	1,209	1,079
Macon	121	1,068	1,245	1,124
Savannah	97	1,100	1,254	1,156
Rural	418	994	1,212	1,081
Kansas				
Kansas City	541	1,057	1,113	1,060
Topeka	95	998	1,139	1,035
Wichita	255	979	1,058	1,003
Rural	204	972	1,203	1,046

TABLE A-2 (continued)

MEAN MEDICARE ALLOWED CHARGES BY PACEMAKER INSERTION BY MARKET AREA, 1986[a]

			ADJUSTED FOR GEOGRAPHIC PRACTICE COST DIFFERENCES	
Area	n	Actual	Total Practice Costs	Overhead Costs Only
New Jersey				
Passaic-Bergen	441	$1,410	$1,224	$1,298
Jersey City	96	1,348	1,206	1,295
Middlesex-Somerset	324	1,430	1,228	1,329
Monmouth	276	1,191	1,054	1,145
Newark	891	1,388	1,199	1,319
Philadelphia	381	1,307	1,190	1,236
Trenton	177	1,377	1,225	1,309
Oklahoma				
Oklahoma City	534	959	1,074	999
Tulsa	331	1,026	1,116	1,066
Rural	151	906	1,082	993
Oregon				
Portland	191	585	586	578
Eugene	61	820	878	816
Medford	59	753	800	754
Salem	68	729	774	730
Rural	87	710	762	718
Washington				
Seattle	389	865	811	844
Spokane	150	979	1,004	991
Tacoma	120	955	916	955
Yakima	56	812	808	822
Rural	177	919	961	927
Wisconsin				
Milwaukee	118	592	591	601
Madison	335	719	779	739
Rural	52	677	796	723
All Areas	10,287	996	1,037	1,013
Ratio of Highest to Lowest Charge Areas		2.44	2.14	2.30

[a]Weighted means have been calculated across three pacemaker codes (atrial, ventricular and AV-sequential), using national frequencies as the weights.

Source: Medicare Part B Claims, 1986.

TABLE A-3

MEAN MEDICARE ALLOWED CHARGES FOR CAROTID THROMBOENDARTERECTOMY BY MARKET AREA, 1986

Area	n	Actual	Adjusted for Geographic Practice Cost Differences: Total Practice Costs	Adjusted for Geographic Practice Cost Differences: Overhead Costs Only
Alabama				
Tuscaloosa	61	$1,022	$1,182	$1,073
Birmingham	513	1,019	1,113	1,065
Huntsville	98	1,005	1,079	1,056
Mobile	224	1,017	1,158	1,064
Montgomery	104	1,031	1,140	1,084
Rural	94	1,026	1,186	1,111
Arizona				
Phoenix	455	1,790	1,740	1,750
Tucson	118	1,853	1,885	1,831
Connecticut				
Hartford	138	1,395	1,327	1,350
New Haven	120	1,742	1,707	1,675
Georgia				
Atlanta	566	1,582	1,677	1,587
Columbus	52	1,338	1,607	1,435
Macon	121	1,326	1,545	1,395
Savannah	94	1,532	1,747	1,610
Rural	372	1,559	1,899	1,695
Kansas				
Kansas City	372	1,458	1,535	1,462
Topeka	380	1,500	1,711	1,555
Wichita	283	1,510	1,632	1,547
Rural	195	1,494	1,849	1,607
New Jersey				
Atlantic City	68	1,941	1,837	1,904
Passaic-Bergen	176	1,890	1,640	1,741
Middlesex-Somerset	138	1,936	1,662	1,799
Monmouth	209	2,030	1,797	1,952
Newark	250	1,870	1,615	1,778
Philadelphia	199	1,805	1,642	1,706
Trenton	86	1,897	1,688	1,803

TABLE A-3 (continued)

MEAN MEDICARE ALLOWED CHARGES FOR CAROTID THROMBOENDARTERECTOMY BY MARKET AREA, 1986

			ADJUSTED FOR GEOGRAPHIC PRACTICE COST DIFFERENCES	
Area	n	Actual	Total Practice Costs	Overhead Costs Only
Oklahoma				
Oklahoma City	219	$1,519	$1,702	$1,583
Tulsa	205	1,568	1,597	1,525
Rural	55	1,309	1,564	1,434
Oregon				
Portland	355	1,633	1,638	1,614
Eugene	155	1,444	1,546	1,437
Medford	83	1,482	1,574	1,484
Salem	108	1,487	1,577	1,488
Rural	188	1,503	1,614	1,521
Washington				
Seattle	535	1,585	1,486	1,546
Olympia	52	1,509	1,524	1,602
Spokane	241	1,671	1,547	1,527
Tacoma	120	1,672	1,603	1,673
Rural	173	1,295	1,748	1,686
Wisconsin				
Appleton-Oshkosh	84	1,295	1,398	1,360
Milwaukee	248	1,227	1,225	1,246
Green Bay	72	1,282	1,361	1,346
Madison	338	1,292	1,399	1,328
All Areas	8,407	1,502	1,551	1,512
Ratio of Highest to Lowest Charge Areas		2.02	1.76	1.85

Source: Medicare Part B Claims.

TABLE A-4

MEAN MEDICARE ALLOWED CHARGES FOR HIP FRACTURES BY MARKET AREA[a]

Area	n	Actual	Adjusted for Geographic Practice Cost Differences: Total Practice Costs	Adjusted for Geographic Practice Cost Differences: Overhead Costs Only
Alabama				
Anniston	97	$1,101	$1,237	$1,175
Birmingham	525	1,184	1,294	1,238
Dothan	189	1,160	1,329	1,225
Florence	87	1,087	1,165	1,153
Gadsden	84	1,071	1,226	1,143
Huntsville	175	1,098	1,179	1,153
Mobile	299	1,219	1,388	1,275
Montgomery	181	1,133	1,253	1,191
Tuscaloosa	150	1,147	1,327	1,204
Rural	504	1,095	1,266	1,186
Arizona				
Phoenix	1,037	1,295	1,259	1,267
Tucson	457	1,152	1,172	1,139
Rural	296	1,183	1,254	1,207
Connecticut				
Bridgeport	198	1,245	1,039	1,157
Danbury	101	1,341	1,119	1,248
Hartford	359	1,177	1,119	1,138
Meriden-New Haven	219	1,320	1,294	1,270
Middletown	99	1,040	989	1,006
New Britain	107	1,170	1,113	1,132
New London	104	1,131	1,106	1,099
Norwalk	81	1,213	1,004	1,119
Stamford	131	1,247	1,041	1,160
Waterbury	145	1,145	1,122	1,102
Rural	159	1,122	1,148	1,113
Georgia				
Albany	104	1,030	1,147	1,094
Athens	160	1,074	1,272	1,143
Atlanta	1,274	1,287	1,364	1,291
Columbia-Richland	211	1,122	1,280	1,189
Columbus	135	1,108	1,330	1,188
Macon	272	1,094	1,274	1,150
Savannah	137	1,121	1,278	1,178
Rural	1,129	1,055	1,286	1,148
Kansas				
Kansas City	611	1,191	1,254	1,195
Lawrence	53	992	1,191	1,037
Topeka	209	1,030	1,175	1,068
Wichita	339	1,039	1,123	1,065
Rural	934	1,017	1,260	1,095

TABLE A-4 (continued)

MEAN MEDICARE ALLOWED CHARGES FOR HIP FRACTURES BY MARKET AREA[a]

Area	n	Actual	ADJUSTED FOR GEOGRAPHIC PRACTICE COST DIFFERENCES: Total Practice Costs	Overhead Costs Only
New Jersey				
Atlantic City	269	$1,267	$1,200	$1,244
Jersey City	170	1,476	1,320	1,418
Middlesex-Somerset	402	1,541	1,321	1,430
Monmouth	482	1,331	1,178	1,280
Newark	694	1,524	1,316	1,449
Passaic-Bergen	745	1,522	1,320	1,401
Philadelphia	491	1,243	1,131	1,175
Trenton	178	1,334	1,187	1,268
Vineland-Millville	63	1,218	1,251	1,204
Rural	64	1,503	1,508	1,514
Oklahoma				
Comanche	75	974	1,124	1,046
Enid	98	871	1,033	921
Oklahoma City	810	1,065	1,193	1,110
Tulsa	488	1,152	1,253	1,197
Rural	817	988	1,180	1,082
Oregon				
Eugene	155	1,093	1,170	1,088
Medford	96	1,153	1,224	1,154
Portland	730	1,204	1,207	1,189
Salem	178	989	1,049	989
Rural	570	1,111	1,193	1,124
Washington				
Bellingham	102	1,149	1,148	1,139
Bremerton	84	1,162	1,066	1,150
Olympia	90	1,155	1,079	1,135
Richland	61	1,078	1,035	1,039
Seattle	1,036	1,197	1,123	1,168
Spokane	274	1,068	1,095	1,081
Tacoma	325	1,154	1,107	1,155
Vancouver	111	1,155	1,139	1,162
Yakima	147	1,122	1,117	1,135
Rural	546	1,142	1,193	1,151
Wisconsin				
Appleton-Oshkosh	237	1,004	1,084	1,054
Green Bay	126	943	1,001	990
Kenosha	51	1,100	1,143	1,109
LaCrosse	74	1,131	1,302	1,184
Madison	1,146	1,155	1,251	1,188
Milwaukee	649	1,153	1,151	1,171
Racine	119	1,102	1,272	1,155
Sheboygan	65	1,008	1,126	1,061
Rural	628	1,081	1,271	1,155
All Areas	23,651	1,156	1,191	1,166
Ratio of Highest to Lowest Charge Areas		1.77	1.52	1.64

[a] Weighted means have been calculated across two hip fracture codes using national frequencies as weights.

Source: Medicare Part B Claims, 10 States, 1986.

TABLE A-5

MEAN MEDICARE ALLOWED CHARGES FOR HIP REPLACEMENTS BY MARKET AREA[a]

Area	n	Actual	Adjusted for Geographic Practice Cost Differences: Total Practice Costs	Adjusted for Geographic Practice Cost Differences: Overhead Costs Only
Alabama				
Birmingham	465	$2,508	$2,739	$2,622
Dothan	50	2,415	2,768	2,550
Florence	94	2,357	2,526	2,499
Huntsville	95	2,210	2,374	2,323
Mobile	151	2,217	2,525	2,319
Montgomery	88	2,412	2,666	2,534
Rural	161	2,379	2,750	2,578
Arizona				
Phoenix	816	2,491	2,422	2,437
Tucson	266	2,406	2,447	2,377
Rural	65	2,468	2,616	2,518
Connecticut				
Hartford	303	2,417	2,299	2,339
Meriden-New Haven	93	2,586	2,533	2,487
New Britain	50	2,394	2,277	2,317
Waterbury	117	2,383	2,335	2,292
Rural	55	2,247	2,298	2,229
Georgia				
Athens	60	2,417	2,862	2,570
Atlanta	589	2,331	2,471	2,338
Columbia-Richland	73	2,498	2,852	2,650
Columbus	105	2,279	2,736	2,444
Macon	65	2,093	2,439	2,202
Savannah	87	2,053	2,340	2,157
Rural	221	2,257	2,750	2,454
Kansas				
Kansas City	549	2,092	2,203	2,098
New Jersey				
Atlantic City	95	2,412	2,283	2,366
Middlesex-Somerset	219	2,402	2,062	2,233
Monmouth	237	1,974	1,747	1,897
Newark	572	2,378	2,051	2,258
Passaic-Bergen	318	2,345	2,034	2,159
Philadelphia	171	2,184	1,987	2,065
Trenton	60	2,033	1,809	1,931

TABLE A-5 (continued)

MEAN MEDICARE ALLOWED CHARGES FOR HIP REPLACEMENTS BY MARKET AREA[a]

Area	n	Actual	ADJUSTED FOR GEOGRAPHIC PRACTICE COST DIFFERENCES: Total Practice Costs	ADJUSTED FOR GEOGRAPHIC PRACTICE COST DIFFERENCES: Overhead Costs Only
Oklahoma				
Oklahoma City	337	$1,915	$2,145	$1,996
Tulsa	154	1,889	2,056	1,963
Rural	181	1,623	1,939	1,779
Oregon				
Eugene	99	2,213	2,368	2,202
Medford	102	1,999	2,122	2,001
Portland	390	2,215	2,222	2,189
Salem	92	2,172	2,304	2,173
Rural	291	2,157	2,315	2,182
Washington				
Olympia	53	2,166	2,024	2,128
Seattle	714	2,225	2,087	2,171
Spokane	224	2,375	2,436	2,405
Tacoma	184	2,131	2,044	2,133
Vancouver	52	1,745	1,721	1,756
Yakima	88	2,059	2,048	2,083
Rural	259	2,215	2,315	2,233
Wisconsin				
Appleton-Oshkosh	181	1,857	2,005	1,950
Green Bay	156	2,060	2,186	2,162
Madison	711	2,197	2,379	2,259
Milwaukee	501	1,724	1,721	1,750
Rural	243	1,960	2,306	2,095
All Areas	11,367	2,199	2,299	2,229
Ratio of Highest to Lowest Charge Areas		1.59	1.66	1.47

[a]Weighted means have been calculated across three hip replacement codes using national frequencies as weights.

Source: Medicare Part B Claims, 10 States, 1986.

TABLE A-6

MEAN MEDICARE ALLOWED CHARGES FOR KNEE REPLACEMENTS BY MARKET AREA

			ADJUSTED FOR GEOGRAPHIC PRACTICE COST DIFFERENCES	
Area	n	Actual	Total Practice Costs	Overhead Costs Only
Alabama				
Birmingham	257	$2,502	$2,733	$2,615
Dothan	62	2,519	2,886	2,659
Mobile	89	2,102	2,395	2,200
Rural	105	2,462	2,846	2,668
Arizona				
Phoenix	736	2,378	2,312	2,326
Tucson	217	2,061	2,099	2,040
Rural	107	2,241	2,376	2,287
Connecticut				
Hartford	132	2,190	2,083	2,119
Waterbury	56	2,201	2,157	2,117
Georgia				
Athens	54	1,855	2,196	1,972
Atlanta	302	2,174	2,305	2,181
Columbus	163	2,299	2,760	2,465
Savannah	57	2,187	2,493	2,298
Rural	206	2,087	2,544	2,270
Kansas				
Kansas City	467	2,263	2,383	2,270
Topeka	147	2,285	2,607	2,369
Wichita	221	2,303	2,489	2,360
Rural	329	2,259	2,797	2,431
New Jersey				
Middlesex-Somerset	121	2,579	2,212	2,395
Monmouth	84	2,163	1,915	2,079
Newark	180	2,568	2,210	2,433
Passaic-Bergen	181	2,615	2,269	2,408
Philadelphia	154	2,260	2,057	2,137
Oklahoma				
Enid	54	1,561	1,858	1,657
Oklahoma City	390	1,687	1,888	1,757
Tulsa	116	2,233	2,429	2,320
Rural	178	1,624	1,941	1,780

GEOGRAPHIC VARIATION IN SURGICAL FEES

Draft Report

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF TABLES

TABLE OF TABLES (continued)

alone would actually overstate the extent of variation. Alternatively, if high fees are accompanied by more bills for related services, then geographic fee variation may be even greater than generally thought.

This report seeks to analyze the variation in surgical fees across market areas, looking at the roles played by physician practice costs, the involvement of other physicians in the surgery itself, the extent of extra billing by the surgeon for visits, and characteristics of the areas themselves. In particular, we address the following questions:

- What is the extent of variation in surgical fees across market areas, like MSAs? Can we narrow the fee differential by adjusting for differences in physician practice costs?

- To what extent is geographic fee variation explained by differences in the definition of the global fee? Do surgeons receive lower fees in areas where the surgical package is less inclusive (and hence they can bill for more postoperative visits)?

- Is the variation reduced when we consider extra surgery charges, suggesting that higher fees in one area may be due to a "go it alone" practice style (i.e., less use of assistants or other surgeons)?

- What effect do market area characteristics, like physician supply and per capita income, have on surgical fees?

- What impact will the 1987 reconciliation provisions have on current fee variation? To what extent might the reductions unfairly penalize surgeons practising in high cost of practice areas (because the formula does not adjust area prevailings for practice costs)?

These questions and many more are addressed in the following chapters of this report.

1.2 Reimbursement of Surgical Procedures under Medicare

1.2.1 Medicare Payment Rules

As with all physician services, Medicare reimburses surgeons using the customary, prevailing, and reasonable (CPR) methodology. Surgeons are paid the lesser of their actual charge for a given procedure, their customary charge (defined as the median of their billed charges), or the prevailing charge. The prevailing charge is the maximum allowable payment set by Medicare and is set at the 75th percentile of usual and customary charges in an area. Growth in the prevailing charge over time is constrained by the Medicare Economic Index. Prevailing charges are determined on a procedure-specific basis for a given specialty within a given geographic area, known as a reasonable charge locality. Beginning in 1987, prevailing charges have been set separately for participating and nonparticipating physicians.

1.0 INTRODUCTION

1.1 Statement of the Problem

Tremendous variation in Medicare physicians' fees has been observed both across large geographic areas like states, as well as across smaller localities, like cities and urban-rural areas within states. Differences as great as three to four-fold have been found between the highest and lowest charge areas in the country (Burney *et al*., 1978; OTA, 1986). Policymakers have expressed concern over this degree of fee variation for two reasons. First, physicians may be unwilling to locate in those parts of the country where fees are systematically lower, thus reducing access to care in those areas. Second, areas with exceptionally high physician charges may be a signal that Medicare is "overpaying" for care.

Although fee variation has been documented for all types of physician services, variation in surgical fees is particularly interesting because inter-area differences in the definition of the product are less likely to be a contributing factor. Perceptions of (and hence bills for) what constitutes an inguinal hernia, for example, are apt to be more homogeneous than what is meant by an intermediate office visit or a limited hospital visit. Surgical fees are also of interest because Congress and the Department of Health and Human Services have recently questioned the "inherent reasonablenes" of what Medicare is currently paying for many high volume operations. As part of the Budget Reconciliation Act of 1987, Congress made a two percent across-the-board reduction in prevailing charges for 11 surgical procedures believed to "overpaid".* Additional reductions were made in those areas where the prevailing charge exceeds 85 percent of the national average prevailing charge.

These reductions ignore the legitimate reasons that might explain geographic variation in surgical fees. One obvious reason might be differences in the costs of physician practice across areas; fees may be higher where wages, malpractice premiums, and the prices of other practice inputs are also higher. Other reasons might include differences in the mix of services encompassed within a global surgical fee, and the involvement of other surgeons during the operation. Higher fees in an area might be offset by fewer bills for postoperative surgical visits and fewer bills from assistant surgeons. In this case, simple comparisons of fees for the surgery

*These procedures were hip replacement, knee arthroplasty (including knee replacement), knee arthroscopy, bronchoscopy, pacemaker insertion, coronary artery bypass graft surgery, upper GI endoscopy, prostatectomy, D and C, carpal tunnel release, and cataract surgery. Reductions were not made if the area prevailing was already below the 85th percentile of the national prevailing.

Payment for surgery does vary from that for other physician services in several respects: the concept of a global fee, and special treatment for multiple procedures in a single operative session. Most major surgical procedures are reimbursed through a global fee that covers the operation itself and some predefined amount of pre and postoperative care. Carriers have considerable discretion in determining the types of services to be included and the duration of the time period covered.

Sometimes, surgeons perform two surgical procedures during the same session. If this second procedure is incidental to the first, it is generally not reimbursed, e.g., removal of a hip prosthesis prior to total hip replacement. In other instances, both operations are major procedures in their own right, e.g., aortic valve replacement in combination with coronary artery bypass graft surgery. Because the "skin-to-skin" time is necessarily shorter for the second procedure in these cases, the Medicare policy is to discount the second surgery and pay 50 percent of its reasonable charge. Carriers vary, however, in their definition of what constitutes major, non-incidental, surgery.

Both of these reimbursement factors may affect the size of the surgeon's fee. Fees may be higher in areas where the global fee is more encompassing, where it includes preoperative as well as postoperative visits, for example, or where the follow-up period is longer. Conversely, average fees may be lower in areas where surgeons are apt to perform other major surgery at the same time, i.e., more frequent "discounting" will lower the mean allowed charge.*

1.2.2 Who Pays When the Surgeon Needs Help?

As a rule, Medicare pays the primary surgeon who performed the operation based on the CPR methodology without regard to any help that surgeon might have received from assistants.** There is as much or more variation in the use of assistant surgeons, however, as there is variation in the fees themselves. An extra pair of skilled hands in the operating room may help the operation go more quickly and thus raise the surgeon's productivity. Are low surgical fees offset by a greater prevalence of bills from assistant surgeons? If so, then a more appropriate comparison would be across total surgery charges, rather than the surgeon's fee alone.

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*This "discounting" only affects comparisons of average allowed charges; prevailings are unaffected.

**An exception is pacemaker insertion where two physicians may be actively involved: one to make the pocket for the device and one to insert the electrodes. In this instance, carriers generally, but not always, reimburse each physician a smaller amount than what a single surgeon performing the entire procedure would receive.

Geographic variation in the use of assistant surgeons is probably due to a number of factors, including the clinical necessity of assistance, local physician practice, and the locus of care. When the operation is performed in a teaching hospital, a resident may frequently serve as assistant surgeon and, in this instance, no Part B bill is submitted. The cost of residents' services are borne by the hospital and subsidized by the Part A portion of Medicare. When the surgeon is assisted by an attending (non-resident) surgeon, on the other hand, whether in a teaching or a non-teaching hospital, the cost is borne directly by Part B and by the patient (in the form of co-pays).

1.2.3 Reductions in "Overpriced" Procedures under the 1987 Budget Reconciliation Act

A number of surgical procedures are believed to be "overpaid" relative to the physician effort involved in performing them (see, for example, Mitchell *et al*., 1987; and PPRC, 1988). As part of the Budget Reconciliation Act of 1987, Congress acted to reduce Medicare payments for eleven specific types of surgical procedures: total hip replacement, knee arthroplasty, knee arthroscopy, bronchoscopy, permanent pacemaker insertion, CABG surgery, upper GI endoscopy, prostatectomy (both transurethral and suprapubic), D & C, carpal tunnel release, and cataract surgery*. These procedures had been identified by the Physician Payment Review Commission as "overvalued" by Medicare, i.e., Medicare was paying substantially more for these procedures compared with other insurors.

Unlike other physician services which received an MEI increase in 1988, prevailing charges for these procedures were not updated and instead a 2 percent reduction went into effect on April 1, 1988. Prevailing charges were then further reduced on a sliding scale basis: each locality's prevailing was reduced by 3/13 of one percent for each percentage point that it exceeded 85 percent of the *national* prevailing charge. The maximum additional reduction was 15 percent. If an area's prevailing charge was already below 85 percent of the national prevailing, then no reduction was made (not even the initial 2 percent cut).

The above formula was used to calculate prevailing charges for participating physicians. The effective prevailing charge for *non*participants was then reduced by an additional 4.5 percent.

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*Cataract surgery had also been the subject of earlier payment reductions as part of the 1986 budget reconciliation provisions.

1.3 Executive Summary

Study Methods

In order to study geographic variation in surgical fees, we assembled a unique data base from Part B claims and carriers' physician directories. Because the BMAD samples were too small for most market areas, we obtained all 1986 Medicare physician claims from ten states, representing the nine census divisons: Alabama, Arizona, Connecticut, Georgia, Kansas, New Jersey, Oklahoma, Oregon, Washington, and Wisconsin. Market areas were constructed based on the location of the surgeon's practice, and were defined as MSAs; rural areas within each state were specified as single markets. The surgeon's location was determined by merging his/her practice's address to each claim. To our knowledge, this is the first time that Medicare allowed charges have been analyzed based on market areas; previous studies have been limited to the reasonable charge locality.

Eight surgical procedures were selected for study, representing three groups of surgery:

(1) cardiovascular surgery: coronary artery bypass graft (CABG) surgery, permanent pacemaker insertion, and carotid thromboendarterectomy.

(2) orthopedic surgery: total hip replacement, hip fracture with internal fixation, and total knee replacement.

(3) general surgery: cholecystectomy and partial colectomy.

Analytic files were created for each procedure, retaining detail on services billed during the seven days prior to surgery, the day of the operation itself, and 90 days postoperatively.

Of particular interest was the role of physician practice cost differences in explaining fee variation across areas. We adjusted for such factors, using the Geographic Practice Cost Index developed by researchers at the Center for Health Economics Research and the Urban Institute.

How Much Do Surgical Fees Vary?

Substantial inter-area variation in surgical fees was observed for all eight procedures:

- Surgeons' allowed charges for CABG surgery varied almost two-fold, for example, ranging from $2,787 in Macon (Georgia) to $5,394 in Newark. Similarly, Medicare paid an average of $2,586 for a hip replacement in New Haven, Connecticut but only $1,724 for the same operation in Milwaukee.

Differential rates of technology diffusion across MSAs is one possible explanation of such fee variation, but

- Even long-established operations like cholecystectomy showed wide ranges in fee levels across market areas. Surgeons in Jersey City received nearly twice as much for performing this procedure as did their colleagues in Anniston (Alabama), $1,095 versus $583.

<u>Impact of Geographic Practice Cost Differences</u>

Geographic cost of practice differences are an important factor in explaining this fee variation. Surgeons' fees are significantly higher in areas where the cost of running a medical practice are relatively greater. Nevertheless,

- Considerable variation in surgical fees remain. While practice cost adjustment reduces the charge "gap" for CABG surgery considerably, thoracic surgeons in Newark still receive over $1,000 more per operations than do those in Macon ($4,552 versus $3,432).

Furthermore, after we adjust for their lower practice costs, surgeons practising in rural areas often appear to be relatively <u>better</u> paid than their urban colleagues.

- General surgeons in the Birmingham MSA currently receive $850 for a cholecystectomy, for example, while those in rural areas are paid somewhat less ($768). Relative charges deflated for practice costs are $894 and $950 for Birmingham and rural Alabama, respectively.

<u>Variations in Global Fee Definition</u>

While all surgeons are paid a global fee to cover the operation itself and some amount of pre and postoperative care, the definition of the global fee package varies across markets, because of differences in carrier policies as well as in area practice patterns. Surgical fees might be higher in some areas because more pre/postoperative visits are included in the global fee, as measured by fewer bills being submitted by the surgeon.

- As a rule, bills for visits or consultations are rarely submitted by surgeons in any market area, suggesting that most surgeons share a common definition of the global fee. When bills are submitted, they are generally for a preoperative consultation in the hospital.

- Regression analysis, however, found that higher fees tended to be accompanied by <u>more</u> bills for same day or preoperative visits by the surgeon (rather than fewer as expected). Patients receiving a bill from their thoracic surgeon for a visit during the week prior to surgery also paid $80 more for the CABG operation itself, for example.

Regression findings for postoperative visits were more ambiguous:

- More bills for postoperative visits were associated with lower fees for four of the eight procedures, but the dollars involved are small. The surgeon who extra-bills for these visits following carotid thromboendarterectomy, for example, lowers his/her fee by $6 per visit. Furthermore, this $6 reduction per visit is only a fraction of what Medicare paid the surgeon for the visit itself.

Variation in Use of Assistant Surgeons

The surgeon's fee is unaffected by the use of assistant surgeons, yet an "extra pair of hands" may enhance the surgeon's productivity by shortening OR time. Their use raises the total cost of surgery to the patient and to the Medicare program, however, as an additional bill is submitted (unless a resident assists, in which case the costs are borne by Part A). All eight procedures show considerable variation in the use of fee-for-service (non-resident) assistant surgeons. For example:

- The use of assistants during hip fracture surgery ranged from 5 percent of operations in Hartford and Oklahoma City to 40 percent in Seattle. The more complex joint replacements exhibited even greater variability in assistant surgeon billings.

- While the availability of orthopedic residency programs is undoubtedly a factor, all of the ten large MSAs, except Hartford, have such programs. Possible explanations may lie in the resident-to-operation workload, the availability of fee-for-service orthopedic surgeons, etc. This is an area in which more research is clearly needed.

Variation in How the Operation is Performed

Finally, there also appeared to be considerable variation in the actual performance of the surgery. For example:

- Thoracic surgeons in Birmingham, Hartford, Seattle, and Milwaukee performed other open heart surgery (generally valve replacement) during 10 percent or more of all CABG operations. By contrast, surgeons in Phoenix, Oklahoma City, and Portland virtually never did so. To what extent can we attribute this to underlying epidemiologic differences, or do surgeons in some areas simply prefer to combine procedures in a single OR sitting rather than conduct them during separate admissions?

- While some surgeons insert pacemakers alone, others prefer to team up with a cardiologist. This team approach was almost never employed in Birmingham and Oklahoma City, but was used in over two-thirds of all Milwaukee pacemakers. Since two separate bills are submitted, the use of the team approach can distort fee comparisons. When only a single bill is analyzed, Milwaukee boasts an average pacemaker fee only one-half that of many other areas. However, the "true" cost of pacemaker insertion is considerably higher.

Simulated Impacts of OBRA Overpriced Procedure Roll-Backs

As part of OBRA-87, Congress reduced Medicare prevailing charges for eleven types of surgical procedures that were considered to be "overpriced". The formula used to do this was constructed in such a way as to "roll-back" payments disproportionately more in high fee areas. We simulated the impact of these roll-backs for three procedures: total hip replacement, CABG surgery, and pacemaker insertion.

- The average reduction (as a percent of the 1987 allowed charge) was relatively small. The average hip replacement charge in our ten states would be reduced by 2.7 percent, for example.

- The range in the payment reductions was considerable, however, as intended by Congress. Over one-fourth of the bills for hip replacement would not incur any additional reductions, while a small number (less than 3 percent) would be cut 10 percent or more from current charge levels.

Because the sliding scale formula imposed by Congress ignored practice cost differences, however, surgeons in high cost-of-practice areas appear to have been disproportionately penalized.

- Orthopedic surgeons in Hartford and Newark averaged roll-backs of 4 percent or more. If the prevailing charge screens had been adjusted by the geographic practice cost index before applying the formula, however, their reductions would have been minimal.

By contrast, surgeons practising in low cost of practice areas would enjoy minimal reductions, even though their fees are high in real terms. Kansas City and Oklahoma City orthopedic surgeons, for example, would have faced greater roll-backs, if their charge screens had first been adjusted for cost differences. The practice cost adjustment to the roll-back formula would especially alter the relative distribution of the reductions across urban and rural areas.

- Although surgeons in rural areas often (but not always) charge lower fees than their urban colleagues in the same state, their fees are not nearly as low as would have been expected given their areas' relatively low practice costs. Incorporation of the practice costs into the formula would greatly increase the charge reductions in rural areas.

It should be noted, however, that the Geographic Practice Cost Index is still preliminary, and index values for very small MSAs and rural areas may be somewhat unreliable. We are currently conducting research to refine the index, and will be able to re-do some of the analyses.

The team approach to pacemaker insertion introduces additional inequities in how the roll-backs have been implemented. Because the prevailing charge screens are applied to single bills, rather than to the total charge for pacemaker insertion, team physicians effectively avoid the overpriced procedure reductions.

Finally, Congress explicitly provided that nonparticipating physicians should bear a relatively larger share of the overpriced procedure reductions. Based on our simulations, Congress would appear to have been successful in doing this:

- Nonparticipating physicians would be more likely to experience charge reductions, and to receive larger reductions, compared with participants.

1.4 Overview of Report

The report includes six additional chapters. Chapter 2 describes the unique data bases we assembled and the methods used to construct analytic files. This chapter also discusses the methodology used to define market areas, the rationale for the surgical procedures selected for study, and the construction of the Geographic Practice Cost Index. Chapters 3, 4, and 5 present analyses of the cardiovascular, orthopedic, and general surgical procedures, respectively. Each of these three chapters is identical in format, and includes both descriptive and multivariate analyses of variations in surgeons' fees and practice patterns. In Chapter 6, we attempt to identify patterns within and across procedure groups, using correlational analyses. Do orthopedic surgeons in a given area consistently use assistant surgeons for all three orthopedic procedures, for example? If so, do thoracic and general surgeons in that area exhibit the same patterns? Finally, Chapter 7 simulates the OBRA-87 charge reductions for three overpriced procedures.

2.0 DATA SOURCES AND METHODS

2.1 Overview

In this chapter, we describe the unique data base assembled to study geographic fee variation. To our knowledge, this is the first time that Medicare allowed charges have been analyzed based on the market area of the physician's practice. Previous studies have been limited to the reasonable charge locality. The data sources are described in Section 2.2 and in Section 2.3 we discuss the specific surgical procedures we selected for this report. The methods used to create physician market areas are presented in Section 2.4. File construction and data cleaning are described in 2.5. Section 2.6 concludes with a list of secondary data sources, like the Area Resource File, used in some analyses. Most important, this section describes the Geographic Practice Cost Index developed earlier by researchers at the Center for Health Economics Research and the Urban Institute. This index is used to adjust surgeons' fees for cost-of-practice differences across market areas.

2.2 Data Bases

2.2.1 Market Area Selection

Ideally, our study would be based on a national sample of geographic areas. The only national Part B data available, however, are the BMAD files which are based on a 5 percent sample of providers and beneficiaries, respectively. These samples are too small to present a reliable picture of fees and practice patterns, except for the very largest SMSAs. A five percent sample of beneficiaries would yield only seven hip replacements and four or five coronary artery bypass graft operations in Portland, Oregon (based on national Medicare rates published by Lubitz et al., 1985). Equivalent numbers in Eugene would be even smaller. A five percent sample of providers would also produce insufficient numbers, and would artificially constrain within-market fee variation.

In order to obtain sufficient sample sizes and to obtain a reliable picture of complete surgical activity at the market area level, we developed our own data base from Part B claims obtained directly from the carriers. We selected nine states to represent each of the nine census divisions. As can be seen from Table 2-1, there are actually two states from the Pacific census division. Washington claims were already available to us through another

TABLE 2-1

STUDY STATES AND THEIR MAJOR METROPOLITAN MARKET AREAS

Census Division	State	Metropolitan Market Areas[a]
New England	Connecticut	Waterbury, Bridgeport, Hartford, Meriden-New Haven, Middletown, New London, New Britain, Danbury, Stamford, Norwalk, Bristol
Middle Atlantic	New Jersey	Trenton, Jersey City, Passaic-Bergen, Newark, Middlesex-Somerset, Atlantic City, Monmouth, Vineland-Millville
East North Central	Wisconsin	Appleton-Oshkosh, Milwaukee, Eau Claire, Duluth, Madison, Racine, LaCrosse, Janesville-Beloit, Green Bay, Kenosha, Sheboygan, Wausau
West North Central	Kansas	Kansas City, Wichita, Topeka, Lawrence
South Atlantic	Georgia	Macon, Columbus, Atlanta, Savannah, Athens, Albany, Augusta, Columbia-Richland
East South Central	Alabama	Huntsville, Mobile, Montgomery, Birmingham, Dothan, Gadsden, Tuscaloosa, Florence, Anniston
West South Central	Oklahoma	Tulsa, Oklahoma City, Enid, Commanche,
Mountain	Arizona	Phoenix, Tucson
Pacific	Washington	Seattle, Spokane, Tacoma, Olympia, Richland, Bellingham, Vancouver, Bremerton, Yakima,
	Oregon	Portland, Salem, Medford, Eugene,

[a]Underlined MSAs have populations of 1 million or more.

Source: U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, 1985.

study (Mitchell et al., 1988), and we added Oregon for two reasons. First, its carrier agreed to supply claims for two other states (Oklahoma and Arizona), and the marginal data acquisition costs for Oregon were small. Second, Oregon is a state with relatively high HMO activity, and we had wanted to ensure a good mix of areas with varying levels of HMO enrollment.

In choosing these states, we sought to ensure that we would achieve the following criteria:*

(1) Very large matropolitan areas should be included, as well as smaller urban, and rural areas. Our ten states includes eight SMSAs with populations of at least one million.

(2) The states should represent areas with varying levels of HMO enrollment.

(3) The states should represent areas with varying levels of physician density, permitting analysis of competitive pressures on surgical fees.

(4) They should represent a range of Medicare physician participation rates.

These characteristics are displayed for all ten states in Table 2-2. The ten states combined represent about 18 percent of all Medicare beneficiaries in the U.S. Each of the states is handled by a single Part B carrier, except Kansas where there are two.

2.2.2 Medicare Part B Claims

This study is based on surgical services provided during calendar year 1986, the most recently available time period. The Part B carriers provided us with their raw claims, about 75 million in all. We then identified those surgical procedures of interest and pulled off their claims (as well as all others provided during a designated "episode of illness"). This process is described in detail in Section 2.5.

The following data elements were available on each Part B claim:

- patient ID (HIC number);
- physician ID and specialty;
- date of service;
- physician's reasonable charge locality;
- type of service;
- HCPCS procedure code;
- modifier (if any);
- location of service;
- submitted charge;
- reasonable (allowed) charge; and
- whether the physician accepted the claim on assignment.

*This study of surgical fees is only one of many that will be conducted using this data base, and funded through the same cooperative agreement. Thus the criteria for state selection were broader than they would have been for a study of surgical fees alone.

TABLE 2-2

SELECTED CHARACTERISTICS OF STUDY STATES[a]

Census Division	State	Percent Rural	Patient Care MDs Per 1,000	General Hospital Beds Per 1,000	Total HMO Enrollment	Medicare HMO Enrollment	Medicare Participation Rate
New England	Connecticut	21.0%	2.2	3.5	5.6%	1.3%	22.2%
Middle Atlantic	New Jersey	10.8	1.9	4.3	4.5	0.4	18.0
East North Central	Wisconsin	35.8	1.5	4.8	14.4	0.1	31.0
West North Central	Kansas	32.5	1.5	5.7	3.2	0.02	45.4
South Atlantic	Georgia	35.8	1.4	4.5	2.6	0.04	33.1
East South Central	Alabama	39.3	1.2	5.2	0.7	None	54.4
West South Central	Oklahoma	30.0	1.2	4.3	1.8	None	13.8
Mountain	Arizona	14.8	1.7	3.3	11.3	0.1	15.4
Pacific	Washington	25.5	1.7	3.1	8.7	7.2	23.6
	Oregon	31.7	1.7	3.3	13.2	9.9	18.5

[a]All statistics are for 1984, except for the percent of physicians signing a Medicare participation agreement which is FY 86 data.

Sources: U.S. Department of the Census, Statistical Abstract of the United States, 1985, AHA Guide to the Health Care Field, 1985; AMA, Physician Characteristics and Distribution in U.S., 1985; U.S. Department of Commerce, Bureau of the Census County and City Data Book, 1983; Interstudy National HMO Census, Annual Report on the Growth of HMOs, 1984

For our study purposes, a key piece of information is missing: the location of the physician's practice. In order to study geographic fee variation, we need to be able to construct geographic areas that are reasonable proxies of market areas for physician services. The only geographic identifier available on the claim is reasonable charge locality, the areas used by the carrier for pricing purposes. The existing reasonable charge locality designations, however, reflect, at best, the perceptions of cost differentials in 1965 rather than any real cost-of-practice or market area differences today. Since carriers were responsible for designing the localities, their number vary markedly by state. Some carriers make distinctions solely on the basis of urban and rural location (but without any update for metropolitan growth over the past 20 years); others define several localities within a single SMSA.

We sought to construct area definitions that were consistent across states and that were reasonable representations of the market for physicians' services. Construction of such market areas is described in Section 2.4. First, however, we needed to determine where physician practices were actually located. To do this, we turned to the carriers' provider directories.

2.2.3 Provider Directories

The provider directories are simply the lists of physician names and addresses maintained by the carriers. We obtained a tape copy of the directory from each of our carriers. The directory included provider ID, name, address (including zip code), specialty, participation status and, in most cases, the practice SSN/EIN number. This information was then merged onto each claim.

It should be noted that there is no one-to-one match between provider IDs and individual physicians. A provider ID refers to a given practice in a given location; it may represent a solo physician or a group of twenty. A single practice, furthermore, may have more than one ID, usually indicating an additional office. This second office may be in a separate reasonable charge locality and have a different participation status. While some carriers have a cross-walk that enables them to track multiple provider IDs for the same practice, most carriers issue an unrelated identifier for each location.

2.3 Construction of Physician Market Areas

While an extensive body of research has been conducted to identify market areas for hospitals, relatively little empirical work has been done for physician services. It was not the goal of this study to develop new methods for identifying physician markets; instead we sought to use existing market definitions that were both commonly understood and compatible with the Geographic Practice Cost Index (GPCI). As will be described in more detail

TABLE A-6 (continued)

MEAN MEDICARE ALLOWED CHARGES FOR KNEE REPLACEMENTS BY MARKET AREA

			ADJUSTED FOR GEOGRAPHIC PRACTICE COST DIFFERENCES	
Area	n	Actual	Total Practice Costs	Overhead Costs Only
Oregon				
Eugene	57	$2,008	$2,149	$1,998
Medford	67	2,010	2,134	2,012
Portland	216	2,077	2,084	2,053
Salem	54	1,971	2,091	1,972
Rural	223	2,054	2,205	2,078
Washington				
Seattle	340	2,312	2,169	2,256
Spokane	169	2,465	2,528	2,495
Tacoma	113	2,230	2,139	2,232
Yakima	67	2,036	2,025	2,059
Rural	222	2,348	2,454	2,367
Wisconsin				
Appleton-Oshkosh	186	1,957	2,114	2,055
Green Bay	157	1,989	2,111	2,087
Madison	547	1,948	2,109	2,003
Milwaukee	187	1,770	1,768	1,797
Rural	155	1,881	2,214	2,010
All Areas	7,925	2,160	2,275	2,193
Ratio of Highest to Lowest Charge Areas		1.68	1.61	1.61

Source: Medicare Part B Claims, 10 States, 1986.

TABLE A-7

MEDICARE NOMINAL AND DEFLATED ALLOWED CHARGES FOR CHOLECYSTECTOMIES BY AREA[a]

Area	n	Actual	Adjusted for Geographic Practice Cost Differences: Total Practice Costs	Overhead Costs Only
Alabama				
Anniston	80	$ 583	$ 655	622
Birmingham	760	850	929	889
Dothan	115	843	966	890
Florence	107	748	802	794
Gadsden	105	675	772	720
Huntsville	125	796	855	836
Mobile	390	790	900	827
Montgomery	180	824	911	866
Tuscaloosa	128	750	868	788
Rural	724	768	888	833
Arizona				
Phoenix	934	1,032	1,003	1,009
Tucson	318	954	971	943
Rural	329	912	967	931
Connecticut				
Bridgeport	217	1,012	845	942
Danbury	74	1,054	880	981
Hartford	313	921	876	891
Meriden-New Haven	244	983	964	946
New Britain	108	925	879	895
New London	81	922	901	895
Norwalk	50	1,032	862	960
Stamford	84	1,029	859	958
Waterbury	143	916	898	881
Rural	121	961	983	953
Georgia				
Albany	123	751	836	797
Athens	100	841	996	894
Atlanta	1,137	870	922	873
Columbia-Richland	185	854	975	905
Columbus	131	814	977	873
Macon	196	827	963	870
Savannah	170	815	929	857
Rural	1,215	766	934	833
Kansas				
Kansas City	934	831	875	833
Topeka	125	713	814	740
Wichita	246	742	802	760
Rural	915	745	922	801

TABLE A-7 (continued)

MEDICARE NOMINAL AND DEFLATED ALLOWED CHARGES FOR CHOLECYSTECTOMIES BY AREA

			ADJUSTED FOR GEOGRAPHIC PRACTICE COST DIFFERENCES	
Area	n	Actual	Total Practice Costs	Overhead Costs Only
New Jersey				
Atlantic City	161	$ 979	$ 927	$ 961
Jersey City	202	1,095	980	1,052
Middlesex-Somerset	372	1,029	833	956
Monmouth	631	1,011	895	972
Newark	863	1,064	919	1,012
Passaic-Bergen	693	1,080	937	995
Philadelphia	437	976	888	922
Trenton	163	992	883	943
Vineland-Millville	88	947	973	936
Oklahoma				
Enid	82	811	962	858
Oklahoma City	659	836	937	872
Tulsa	464	869	945	902
Rural	858	781	933	856
Oregon				
Eugene	137	889	952	885
Medford	85	818	868	819
Portland	425	882	884	871
Salem	163	747	792	747
Rural	583	805	864	815
Washington				
Bellingham	68	828	827	821
Bremerton	69	853	783	845
Olympia	76	802	750	788
Seattle	729	802	752	783
Spokane	229	768	787	777
Tacoma	252	853	818	854
Vancouver	59	832	821	837
Yakima	114	744	740	752
Rural	499	797	833	803
Wisconsin				
Appleton-Oshkosh	212	698	754	733
Eau Claire	52	864	945	919
Green Bay	156	744	790	782
Madison	1,166	781	845	803
Milwaukee	692	812	811	824
Racine	85	804	770	823
Wausau	54	756	814	797
Rural	583	762	896	814
All Areas	23,378	856	879	863
Ratio of Highest to Lowest Charge Areas		1.88	1.53	1.69

[a] Weighted means have been calculated across three cholecystectomy codes using national frequencies as weights.

Source: Medicare Part B Claims, 1986.

TABLE A-8

MEDICARE NOMINAL AND DEFLATED ALLOWED CHARGES FOR COLECTOMIES BY AREA

Area	n	Actual	ADJUSTED FOR GEOGRAPHIC PRACTICE COST DIFFERENCES	
			Total Practice Costs	Overhead Costs Only
Alabama				
Birmingham	237	$1,185	$1,293	$1,237
Dothan	54	1,099	1,260	1,161
Gadsden	59	954	1,091	1,017
Huntsville	65	1,187	1,275	1,247
Mobile	144	1,120	1,276	1,172
Montgomery	72	1,169	1,292	1,228
Tuscaloosa	69	944	1,092	991
Rural	199	1,098	1,269	1,189
Arizona				
Phoenix	488	1,294	1,258	1,265
Tucson	204	1,225	1,246	1,211
Rural	121	1,127	1,195	1,150
Connecticut				
Bridgeport	143	1,367	1,142	1,272
Danbury	63	1,589	1,327	1,479
Hartford	244	1,195	1,137	1,157
Meriden-New Haven	132	1,323	1,297	1,273
Middletown	54	1,032	982	999
New London	52	1,116	1,090	1,084
Stamford	75	1,585	1,323	1,475
Waterbury	99	1,219	1,194	1,173
Rural	101	1,138	1,164	1,129
Georgia				
Atlanta	407	1,110	1,177	1,114
Columbia-Richland	60	1,043	1,190	1,105
Macon	77	1,030	1,200	1,084
Savannah	67	1,018	1,160	1,070
Rural	363	978	1,192	1,064
Kansas				
Kansas City	455	1,071	1,128	1,074
Topeka	96	1,019	1,163	1,057
Wichita	107	1,021	1,104	1,047
Rural	426	1,012	1,253	1,089

TABLE A-8 (continued)

MEDICARE NOMINAL AND DEFLATED ALLOWED CHARGES FOR COLECTOMIES BY AREA

			ADJUSTED FOR GEOGRAPHIC PRACTICE COST DIFFERENCES	
Area	n	Actual	Total Practice Costs	Overhead Costs Only
New Jersey				
Atlantic City	126	1,185	1,122	1,163
Jersey City	100	1,487	1,330	1,429
Middlesex-Somerset	240	1,374	1,180	1,277
Monmouth	341	1,404	1,242	1,349
Newark	525	1,454	1,256	1,383
Passaic-Bergen	400	1,480	1,285	1,363
Philadelphia	256	1,290	1,174	1,219
Trenton	152	1,364	1,213	1,296
Oklahoma				
Oklahoma City	298	1,025	1,148	1,068
Tulsa	155	1,101	1,197	1,143
Rural	234	1,024	1,223	1,121
Oregon				
Eugene	63	1,012	1,083	1,007
Medford	63	990	1,052	992
Portland	263	1,058	1,061	1,045
Salem	83	937	994	938
Rural	276	983	1,056	995
Washington				
Olympia	59	1,053	984	1,035
Seattle	428	1,178	1,105	1,150
Spokane	136	1,013	1,039	1,025
Tacoma	165	1,089	1,045	1,090
Yakima	62	1,063	1,057	1,075
Rural	199	1,071	1,119	1,080
Wisconsin				
Appleton-Oshkosh	169	1,043	1,126	1,095
Green Bay	71	1,019	1,082	1,069
Madison	645	1,090	1,181	1,121
Milwaukee	430	1,173	1,171	1,191
Racine	65	1,135	1,087	1,161
Rural	313	1,078	1,265	1,149
All Areas	11,050	1,148	1,168	1,151
Ratio of Highest to Lowest Charge Area		1.70	1.35	1.58

Source: Medicare Part B Claims, 1986.

below, the GPCI was constructed at the Metropolitan Statistical Area (MSA) level; a single value was used for all rural areas within each state.

MSAs are comprised of one or more counties in a state with the exception of Connecticut where the MSAs cross county lines. Table 2-3 lists the 83 market areas for each of our states; this includes 10 rural areas and 73 MSAs. We dropped MSAs that crossed state lines, unless both states were included in our study (e.g., Kansas City, KA-MO, Columbus, GA-AL).*

Considerable work was involved in assigning market areas for physicians in our ten states. First, we cross-walked county codes on the Provider Directory to a CHER County Master File that lists the constituent counties for each MSA. Remaining counties within each state were designated as rural.

In some cases, county codes were missing for providers, and here we used zip codes if available. The SAS zip code/county conversion file was used to identify the county from the zip code. For cases where even the zip code was not listed, we relied upon the English-language description of the town. The appropriate zip code for that town was then identified using the U.S. Postal Service's National Five Digit ZIP Code and Post Office Directory.

In Connecticut, where the MSAs cross county lines, still another approach was required. Software was purchased that maps the zip code coordinates onto a map of Connecticut. A transparency outlining MSAs was overlaid on the zip code map, and market areas were defined.

2.4 File Construction

2.4.1 Selection of Surgical Procedures

Eight surgical procedures were selected for analysis in this report. Additional procedures will be included in future reports. The following criteria were used in choosing the study procedures:

- All of the procedures should be high-volume Medicare operations.
- They should include some operations identified by Congress as "overpaid".
- The procedures should represent a range of old and new technology.
- Where possible, they should be clustered in groups treated by the same specialties. The specialty group should not be limited to only "overpaid" procedures.

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*An exception was made in the case of the Philadelphia MSA which includes several New Jersey counties. We have retained the New Jersey portion of this MSA, because it includes a major metropolitan area (Camden) and because of the high volume of surgical claims found there, suggesting that many (if not most) operations on New Jersey beneficiaries are performed by New Jersey physicians. In later work, when we merge on Part A records, we will have an opportunity to validate this assumption.

TABLE 2-3

PHYSICIAN MARKET AREAS IN THE TEN STATES

Market ID	Name	MSA	County
ALABAMA = 13			
ALM1	Anniston	0450	
ALM2	Birmingham	1000	
ALM3	Dotham	2180	
ALM4	Florence	2650	
ALM5	Gasden	2880	
ALM6	Huntsville	3440	
ALM7	Mobile	5160	
ALM8	Montgomery	5240	
ALM9	Columbus, GA	1800	
ALM10	Tuscaloosa	8600	
ALO11	Selma		047
ALO12	Auburn		081
ALR13	Rural = rest of state		
ARIZONA = 7			
AZM1	Phoenix	6200	
AZM2	Tucson	8520	
AZO3	Flagstaff		005
AZO4	Lake Havasu		015
AZO5	Prescott		025
AZO6	Yuma		027
AZR7	Rural = rest of state		
CONNECTICUT = 13			
CTM1	Bridgeport	1160	
CTM2	Bristol	1170	
CTM3	Danbury	1930	
CTM4	Hartford	3280	
CTM5	Meriden/New Haven	5480	
CTM6	Middletown	5020	
CTM7	Waterbury	8880	
CTM8	New Britain	5440	
CTM9	New London	5520	
CTM10	Norwalk	5760	
CTM11	Stamford	8040	
CTO12	Torrington		005
CTR13	Rural = rest of state		
GEORGIA = 11			
GAM1	Athens	0500	
GAM2	Atlanta	0520	
GAM3	Columbia-Richland	0600	
GAM4	Albany	0120	
GAM5	Chatanooga	1560	
GAM6	Columbus	1800	
GAM7	Macon	4680	
GAM8	Savannah	7520	
GAO9	Valdosta		185
GAO10	Rome		115
GAR11	Rural = rest of state		

TABLE 2-3 (continued)

PHYSICIAN MARKET AREAS IN THE TEN STATES

Market ID	Name	MSA	County
KANSAS = 11			
KSM1	Kansas City	3760 - 3755	
KSM2	Topeka	8440	
KSM3	Lawrence	4150	
KSM4	Witchita	9040	
KSM5	St. Joseph, MO	7000	
KSO6	Hutchinson		155
KSO7	Salina		169
KSO8	Manhattan		161
KSO9	Emporia		111
KSR10	Rural = rest of state KS		
KSR11	Rural = Western MO		
NEW JERSEY = 11			
NJM1	Atlantic City	0560	
NJM2	Passaic-Bergen	0875	
NJM3	Jersey City	3640	
NJM4	Middlesex Somerset	5015	
NJM5	Monmouth	5190	
NJM6	Newark	5640	
NJM7	Philadelphia	6160	
NJM8	Trenton	8480	
NJM9	Vineland-Millville	8760	
NJM11	Allentown PA	0240	041
NJR10	Rural = rest of state		
OKLAHOMA = 10			
OKM1	Comanche	4200	
OKM2	Oklahoma City	5880	
OKM3	Enid	2340	
OKM4	Tulsa	8560	
OKM5	Ft. Smith, AK	2720	
OKO6	Ponca City		071
OKO7	Bartlesville		147
OKO8	Muskogee		101
OKO9	Stillwater		119
OKR10	Rural = rest of state		
OREGON = 8			
ORM1	Portland	6440	
ORM2	Eugene	2400	
ORM3	Medford	4890	
ORM4	Salem	7080	
ORO5	Corvalls		003
ORO6	Albany		043
ORR7	Rural = rest of state OR		
ORR8	Washington		

TABLE 2-3 (continued)

PHYSICIAN MARKET AREAS IN THE TEN STATES

Market ID	Name	MSA	County
WASHINGTON = 12			
WAM1	Seattle	7600	
WAM2	Bellingham	0860	
WAM3	Brementon	1150	
WAM4	Richland	6740	
WAM5	Olympia	5910	
WAM6	Spokane	7840	
WAM7	Tacoma	8200	
WAM8	Vancover	8725	
WAM9	Yakima	9260	
WAO10	Walla Walla		071
WAO11	Longview		015
WAR12	Rural = rest of state		
WISCONSIN = 16			
WIM1	Appleton-Oshgosh	0460	
WIM2	Janesville-Beloit	3620	
WIM3	Milwaukee	5080	
WIM4	Eau Claire	2290	
WIM5	Green Bay	3080	
WIM6	Kenosha	3800	
WIM7	LaCross	3870	
WIM8	Madison	4720	
WIM9	Racine	6600	
WIM10	Sheboygan	7620	
WIM11	DuLuth	2240	
WIM12	Wausau	8940	
WIO13	Fond du Lac		039
WIO14	Manitowac		071
WIM15	Minneapolis, St. Paul, MN	5120	
WIR16	Rural = rest of state		

This last criteria effectively eliminated both cataract surgery and prostatectomy. There are no other operations performed by ophthalmologists and urologists, respectively, that yield adequate numbers of Medicare cases.

Three groups of surgeries were eventually chosen:

(1) cardiovascular surgery: coronary artery bypass graft surgery, permanent transvenous pacemaker insertion, and carotid thromboendarterectomy.

(2) orthopedic surgery: total hip replacement, hip fracture with internal fixation, and total knee replacement.

(3) general surgery: cholecystectomy, and partial colectomy.

Pacemaker insertion and carotid endarterectomy are frequently performed by general surgeons, so they also overlap with the third group.

2.4.2 Creation of Analytic Files

Within each file, the surgical procedure is the unit of observation. Detailed data were retained for all services provided on the same day as the index surgery. Although the exact specification is procedure-specific, examples would include:

- assistant surgeons and anesthesia, both for the index procedure and for any other surgery;
- procedure-specific detail on other major operations performed at the same time;
- procedure-specific detail on diagnostic surgical procedures performed at the same time, e.g., Swan-Ganz catheters;
- hospital visits, ICU visits, and consultations.

In addition, detail on visits and consultations were retained for seven days preoperatively and 90 days postoperatively. This allowed us to specifically examine any extra-billing by surgeons that might indicate area differences in the definition of the global fee. More summary data on other pre- and postoperative services were also retained.

Because 1986 Part A claims data were not available when we initiated file construction, it was not possible to precisely identify the hospital episode during which the index surgery took place. Some unknown number of patients are readmitted to the hospital, possibly for additional surgery, during the 90 day postoperative period. As a result, we may have overestimated postoperative hospital visits associated with the index surgery. To partially adjust for this, we retained two sets of visit data: one for hospital visits during the first 14 days following surgery, and the other for more than 14 days postoperative (up to a maximum of 90 days).

Each procedure file was constructed at the state level. Information describing the surgeon (participation status, specialty, location) were merged on from the Provider Directory. Procedures were then grouped into market areas, using the methodology described earlier.

2.4.3 <u>Data Cleaning</u>

Some amount of bad data are always present in claims data due to keypunch or other errors. Type of service anesthesia or assistant surgery may be mistakenly coded as type of service surgery; or the procedure code itself may be miskeyed. We used the following rules to delete bad cases:

- The specialty of the "surgeon" must be plausible. Anesthesiologists and dermatologists, for example, were dropped.

- Allowed charges that were excessively low or high were deleted. The majority of all such outliers were too low, e.g., $25. This cleaning was performed within reasonable charge locality in order to retain as much natural variation as possible.

About 0.5 percent of cases were dropped on average, using these criteria.

When two operations are performed through the same incision at the same OR sitting, Medicare reimburses the full charge for the first procedure and 50 percent of the charge for the second procedure. This means that some fees may look particularly low relative to the average fee in an area. Ideally, a modifier would be attached to the claims, indicating that multiple operations has been performed and that the fee for one was reduced. Unfortunately, modifiers are not consistently present on the claims files. In an earlier study of two states, we found that <u>total</u> fees definitely appeared to be reduced when CABG surgery was performed simultaneously with valve replacement, but that there was no consistent pattern in <u>which</u> of the two fees was lowered. The only way to even determine whether multiple operations took place is by examining all claims submitted for the same day as the index surgery.

Our initial plan was to exclude cases of major (non-incidental) operations being performed at the same OR sitting on the grounds that they may bias "true" average area fees downwards. We found, however, systematic geographic variation in the relative frequency with which such simultaneous operations occur. This suggests either that surgeons in some areas simply do not "piggy-back" one operation onto another, or that when they do, they do not submit a separate bill. Because the variation was so pronounced (e.g., surgeons rarely perform other open heart surgery with CABG operations in Oregon and Oklahoma but do so quite often in Alabama), and because the number of cases potentially affected was so large (200 observations would be deleted

in Birmingham alone), it was decided to leave these cases in the study. We do, however, examine these practice pattern differences more directly and attempt to estimate the size of the fee reduction.

2.4.4 Number of Study Cases

Following data cleaning, all observations for a given surgery were pooled. Because all tabular analysis was to be performed at the level of the market area, we deleted all market areas with fewer than 50 cases. Table 2-4 displays the actual number of cases used in the analysis by state.

Deletion of market areas with relatively few surgical procedures was performed for two reasons. First, a minimum of 50 operations was considered necessary to produce reliable area-wide means. Even though our data represent the universe of all Medicare activity in these markets, area means could be disproportionately affected by one or two unusual cases. Second, operations in low-volume areas were apt to be performed by the same surgeon. In these instances, especially high (or low) fees and utilization rates would be mistakenly attributed to a given geographic area.

2.4.5 Validity of Using Markets as the Geographic Unit

Since our primary interest is in trying to understand the geographic variations in the surgeons' fees for 8 common surgical procedures, an early task was to find a geographic area that made sense conceptually. As noted above, states were too large and diverse; and cities, while small enough, were legal entities whose historical boundaries had long since been breached by burgeoning populations. The concept of market was appealing because, by definition, it is contemporary and has validity as an inclusive area in which the relevant behaviors are subject to the same conditions. Therefore, using the Metropolitan Statistical Area (MSA) as a base, we constructed physician market areas in each of the 10 states in the study as described in Section 2.3.

Having created these markets, we needed to test them to determine that, in fact, they were suitable for the purposes of the study. That is, we needed to demonstrate that the observed geographic variation in fees was real and not subject to random fluctuations within markets.

To accomplish this purpose, an analysis of variance was run with the surgeons' allowed charges for each procedure (deflated to reflect differences in the costs of practice) as the dependent variable. For those surgeries which included more than one CPT code, the separate procedure codes were used as independent variables, along with market. The results are found in Table 2-5, which shows that, for each surgery, market is indeed a highly significant factor. Therefore, we concluded that our attempt to understand geographic variation in surgical fees under Medicare could be operationalized as an effort to examine the differences between the markets we created.

TABLE 2-4

FINAL SAMPLE SIZES FOR EACH PROCEDURE BY STATE

	Procedure							
State	CABG	Pacemaker	Thromboend-arterectomy	Hip Fracture	Hip Replacement	Knee Replacement	Cholecystectomy	Colectomy
Alabama	2,333	879	1,094	2,291	1,104	513	2,724	899
Arizona	1,189	693	573	1,790	1,147	1,060	1,581	813
Connecticut	1,328	650	258	1,703	669	188	1,435	963
Georgia	1,941	1,505	1,205	3,422	1,200	782	3,257	974
Kansas	1,368	1,095	1,230	2,283	895	1,223	2,220	1,084
New Jersey	1,877	2,586	1,126	3,558	1,672	720	3,610	2,140
Oklahoma	1,187	1,016	479	2,288	672	738	2,063	687
Oregon	814	466	889	1,729	974	617	1,393	748
Washington	1,870	892	1,121	2,776	1,574	911	2,095	1,049
Wisconsin	2,328	505	742	3,095	1,792	1,232	3,000	1,693
All Areas	16,235	10,287	8,407	24,935	11,699	7,984	23,378	11,050

Source: Medicare Part B Claims, 1986.

TABLE 2-5

ANALYSIS OF VARIANCE RESULTS FOR DEFLATED SURGEONS' FEES BY MARKETS

	F Value	Probability	R Squared
Cardiovascular Procedures			
CABG[a]	171.46	.0001	.699
Permanent Pacemaker Insertion[a]	145.85	.0001	.673
Carotid Thromboendartarectomy	415.62	.0001	.676
Orthopedic Procedures			
Hip Fractures[a]	281.22	.0001	.628
Hip Replacement[a]	120.00	.0001	.618
Knee Replacement	244.66	.0001	.560
General Surgical Procedures			
Cholecystectomy[a]	87.97	.0001	.443
Partial Colectomy	140.35	.0001	.421

[a]These operations include several procedure codes; and the results, as presented, reflect the effects of procedures and markets. In each case, however, the effect of market is independent and strong.

Source: Medicare Part B Claims for ten states, 1986.

2.5 Secondary Data Sources

2.5.1 The Geographic Practice Cost Index

Because practice costs vary across geographic areas, there can be legitimate geographic variation in Medicare allowed charges. If physicians in high cost areas are not reimbursed more than those in low cost areas, perverse incentives are created for physicians to locate in low practice cost areas. To account for legitimate geographic variation in physician fees, we first adjust fees for differences among areas in practice costs using the Geographic Practice Cost Index (GPCI) developed by Zuckerman et al., 1988. In this section we summarize the data and methods they used to construct the GPCI.

The GPCI was created for the same MSA and state rural areas described in Section 2.3 above. A standard Laspayres index was used to compare the cost of purchasing an identical market basket of inputs in different areas. Only exogenous input price variation faced by physicians is measured, not differences in input utilization due to output or efficiency variations.

The GPCI reflects geographic variation costs for four of seven broad input categories: physician time, employee time, office rent and malpractice insurance. These four categories comprise about 75 percent of total physician revenues. Because geographic data for the remaining three input categories (medical supplies, medical equipment and other) were not available, costs for these inputs were assumed to be the same in all areas.

According to published 1983 AMA data, expenditures on physician time comprise the bulk of total revenues (57.4%) followed by expenditures on non-physician employees (14.5%), office rent (10.4%) and malpractice (3.5%). These cost shares were used to weight input prices for the four categories in developing the final GPCI.

Because prices for physician services are not determined under competitive market conditions in all areas, physician net income does not necessarily reflect the cost of living in a particular area. For this reason, the median hourly earnings for professionals from the 1980 Census of Population was used to proxy variation in cost of living and amenities among areas. (Presumably professionals flock to areas with both low costs of living and greater social amenities, thereby bidding down the wages such that earnings reflect differences in both pecuniary and non-pecuniary costs of living.)

Currently, the physician price proxy is based on data from the one percent Census public use file rather than the full 20 percent file. The smaller sample size on this file precludes making adjustments for area variations in occupation mix. Consequently, the lower earnings of teachers may be more heavily reflected in areas with few highly trained professionals,

while higher engineer earnings may be reflected in other areas that actually have the same cost of living, biasing the index values for these areas.*

Hourly earnings for administrative support occupations, registered nurses, health technologists and technicians from the 1980 Census are used as the price measure for employee time. Fair market rents for a uniform size apartment were used to proxy medical office rents. These data were obtained from the Department of Housing and Urban Development. Finally, a weighted average of malpractice preminiums for three specialties (general practitioners, general surgeons and orthopedic surgeons) was used to proxy the price of malpractice insurance. Data for a standardized policy of maximum liability coverage of $100,000 per claim and $300,000 per year were obtained from the HCFA Survey of Malpractice Insurors to create this measure.

Prices for malpractice insurance varied the most among areas and employee wages varied the least. Not surprisingly, variation among areas in the final GPCI tracked the variation in the more heavily weighted physician time proxy. Index values ranged from a minimum of .71 to a maximum of 1.49. Rural areas have an average index value of .84 compared to an average 1.05 for urban areas. Western areas (with an average index value of 1.11) are much more expensive than other areas. Areas in the South had the least expensive practice costs (with an average index value of only .92).

While the GPCI undoubtedely reflects genuine differences in practice costs among areas, it is important to keep in mind that some of the differences (particularly between urban and rural areas) may be overstated. Because the price proxy for physician time is such a major component of this index, failure to adjust differences in professional occupation mix may be biasing values upward in urban areas with a large number of highly trained and specialized professionals and biasing them downward in rural areas with fewer highly trained and specialized professionals.

2.5.2 Area Resource File

Differences in market conditions among areas may also explain geographic variation in surgeons' fees. To test this, measures of demand conditions and competiveness such as the number of physicians per capita (by specialty) the degree of utilization and per capita income were obtained from the Area Resource File (ARF). In addition, variables describing the degree of medical support for surgeons were obtained from this file. For example, data on the numbers of residents, surgical staff, operations, and ICU days were collected to help explain differences in practice patterns that might affect surgeon's fees. All the data were obtained at the county level for the most recent year

*Once data from the 20 percent sample become available, the GPCI will be recreated adjusting for occupational mix.

possible. However, for some variables, this meant using 1980 data. Fortunately, there is little change over time in some of these variables (e.g., the number of hospitals that are members of Council of Teaching Hospitals, the number of residency positions). Before merging the ARF variables onto the procedure files, data were aggregated from the county level to MSA and state rural areas.

3.0 SURGEONS' FEES AND PRACTICE PATTERNS FOR CARDIOVASCULAR SURGERY

3.1 Introduction

Three cardiovascular surgical procedures were chosen for study: coronary artery bypass graft (CABG) surgery, permanent transvenous pacemaker insertion, and carotid thromboendarterectomy. Descriptive data and regression results are shown separately for each of these procedures in the following three sections. The reader is referred to Chapter 2 for a detailed description of how the surgical charge data were cleaned, and how the analytic files were constructed.

Two of the three surgical procedures have multiple CPT-4 procedure codes. There are six codes for CABG surgery, depending on the number of bypass grafts inserted, and three codes for pacemaker insertion, based on the type of device implanted. Because Medicare pays differentially based on procedure code, interarea variation in surgical fees could be based in part on variation in procedure code mix. In order to produce comparable mean fees at the area level, we constructed a weighted allowed charge for CABG surgery and pacemaker insertion, using the national procedure code frequencies as the weights.

3.2 Coronary Artery Bypass Graft Surgery

3.2.1 The Surgeon's Fee

The mean allowed charges for CABG surgery for each market area in our ten states are shown in Table 3-1. (Recall that market areas with fewer than 50 operations were excluded from the analysis.) Surgeons' charges vary almost two-fold, ranging from $2,787 in Macon, Georgia to $5,394 in Newark, New Jersey. Adjusting for geographic cost of practice differences reduces the charge "gap" somewhat, but considerable variation remains; the average charge in the most expensive area (still Newark) is 47 percent higher than that in the least expensive area (Tuscaloosa, Alabama).

While all of the market areas on Table 3-1 are MSAs, they vary substantially in population size, physician supply, and possibly in patient severity as well. While CABG surgery is performed regularly in six Alabama MSAs, for example, more difficult cases may be referred to Birmingham. For greater comparability, we show the largest MSA from each state in Table 4-2. Even among these 10 large MSAs and even after adjusment for practice costs, there is a wide range in average surgeons' allowed charges. The average bill for a CABG operation in Newark is almost $1,500 higher than a bill for comparable surgery in Birmingham.

TABLE 3-1

MEAN MEDICARE ALLOWED CHARGES BY MARKET AREA FOR CORONARY ARTERY BYPASS GRAFT SURGERY, 1986[a]

	n	Actual	Deflated by GPCI
Alabama			
Tuscaloosa	154	$2,960	$3,090
Birmingham	1,484	2,985	3,138
Dothan	171	2,790	3,448
Huntsville	155	3,434	3,159
Mobile	235	2,914	3,285
Montgomery	134	3,112	3,602
Arizona			
Phoenix	894	3,810	3,632
Tucson	295	3,993	3,973
Connecticut			
Bridgeport	212	4,139	3,825
Hartford	593	4,238	3,913
New Haven	523	4,285	4,440
Georgia			
Atlanta	1,247	3,085	3,328
Columbia-Richland	249	3,203	3,571
Columbus	66	3,103	3,511
Macon	149	2,787	3,432
Savannah	230	3,198	3,693
Kansas			
Kansas City	752	3,086	3,276
Topeka	152	3,087	3,465
Wichita	464	3,112	3,134
New Jersey			
Passaic-Bergen	645	4,901	4,240
Middlesex-Somerset	106	4,357	3,756
Newark	553	5,394	4,552
(Philadelphia)	508	4,839	4,543
Trenton	65	4,552	4,138

TABLE 3-1 (cont'd)

MEAN MEDICARE ALLOWED CHARGES BY MARKET AREA FOR CORONARY ARTERY BYPASS GRAFT SURGERY, 1986[a]

	n	Actual	Deflated by GPCI
Oklahoma			
Oklahoma City	665	3,744	4,142
Tulsa	522	3,865	4,192
Oregon			
Portland	495	3,700	3,664
Eugene	151	3,464	3,488
Medford	168	3,274	3,244
Washington			
Seattle	1,039	4,088	3,656
Spokane	502	4,135	4,380
Tacoma	329	3,807	3,668
Wisconsin			
Appleton-Oshkosh	221	3,646	4,133
Milwaukee	1,145	4,150	3,948
Madison	189	3,677	3,862
Green Bay	773	3,626	3,773
All Areas	16,235	3,682	3,730
Ratio of Highest to Lowest Charge Areas		1.93	1.47

[a]Weighted means have been calculated across six CABG codes (based on the number of bypass grafts inserted), using national frequencies as weights.

Source: Medicare Part B Claims, 1986.

But are fees for the two surgeries truly comparable? It is possible that charges are lower in an MSA because they represent a less comprehensive package of services. All surgical fees are global fees, that is, they cover the operation itself and some amount of postoperative care, but the <u>extent</u> of follow-up care included in the global fee may vary from one geographic area to another. Some fees, furthermore, may be "discounted" 50 percent, if the CABG surgery was performed at the same time as another open heart operation. Although this is a Medicare-wide policy, the prevalence of such "dual" surgery may vary from area to area.

3.2.2 <u>Variation in "Same Day" Services</u>

Table 3-2 compares the utilization of various physician services associated with CABG surgery for the ten MSAs. There is, in fact, considerable variation in the frequency with which another open heart operation (usually valve replacement) is performed during the bypass surgery. Surgeons in Phoenix, Oklahoma City, and Portland almost never perform such dual operations, but their colleagues in Birmingham and Hartford do so in over 12 percent of all CABG procedures. Later we will examine how much more the surgeon receives per patient when the fee for this second surgery is added in; can low CABG charges in Birmingham be partially explained by the prospensity to combine CABG surgery with other operations?*

A relatively small number of patients in all ten cities receive pacemakers (either permanent or temporary) during the CABG surgery. It is possible that many more do receive temporary pacemakers, but that most surgeons include insertion of these devices in their global fees. Insertion of an intra-aortic balloon catheter can be done either prior to surgery, during the procedure itself, or post-operatively. It is often used to stabilize more seriously ill patients. The relative absence of bills in areas like Phoenix and Portland could indicate less complicated patients, but more probably means that this procedure is apt to be bundled with the operation.

According to the CPT-4 manual, coronary angioplasty performed during the bypass surgery is to be considered part of the operation, and not a separate billable procedure. Sometimes, however, percutaneous transluminal coronary angioplasty is performed <u>in lieu of</u> the more complex CABG procedure, but when problems arise, the surgeon is compelled to go ahead and bypass the

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*The fact that 12 percent of CABG operations in Birmingham were accompanied by another open heart procedure does not mean that 12 percent of the fees were discounted by 50 percent. Either the CABG <u>or</u> the other operation may have been subject to the reduction. While CPT-4 includes modifiers which can be used to inform the insuror that multiple procedures were performed during the same operative session, they are not used in practice. Thus, it is only by merging claims for the same patient for the same day that we can identify these cases.

TABLE 3-2

SURGEONS' FEES AND PRACTICE PATTERNS FOR CABG SURGERY: A TALE OF TEN CITIES[a]

	Birmingham AL	Phoenix AZ	Hartford CT	Atlanta GA	Kansas City KA	Newark NJ	Oklahoma City OK	Portland OR	Seattle WA	Milwaukee WI
Surgeon's Fee	$2,985	$3,810	$4,238	$3,085	$3,086	$5,394	$3,744	$3,700	$4,088	$4,150
Surgeon's Fee (deflated)	3,138	3,632	3,913	3,328	3,276	4,552	4,142	3,664	3,656	3,948
Same Day Services:										
% with other open heart surgery	12.2%	0.2%	12.5%	8.7%	8.0%	1.4%	0.5%	0.3%	11.4%	10.0%
% with pacemaker insertion	1.8%	0.5%	1.0%	0.6%	1.7%	0.3%	0.7%	0.2%	2.7%	1.9%
% with intra-aortic balloon catheter	4.1%	0.9%	9.2%	6.6%	7.0%	4.5%	2.2%	0.0%	4.9%	4.2%
% with angioplasty	0.8%	2.9%	0.4%	1.9%	3.1%	1.3%	0.6%	1.7%	2.3%	1.7%
% with other surgery	4.5%	2.4%	11.9%	16.9%	8.1%	4.5%	2.2%	0.7%	4.3%	4.2%
% with assistant surgeon(s)	28.6%	51.9%	93.1%	32.5%	86.4%	31.0%	86.6%	73.7%	65.0%	10.6%
No. of visits by surgeon	0.00	0.47	0.03	0.19	0.01	0.09	0.00	0.06	0.01	0.00
No. of visits by other MDs	0.12	0.67	0.23	0.81	0.84	0.58	0.91	0.40	0.30	0.44
Pre-Operative Services:										
No. of visits by surgeon	0.02	0.28	0.53	0.77	0.05	0.56	0.31	0.04	0.13	0.01
No. of visits by other MDs	4.11	5.60	7.22	6.49	6.33	5.17	6.58	3.16	5.14	5.58
Post-Operative Services, In Hospital:										
% with surgery for post-op complications	1.6%	3.4%	1.9%	1.1%	1.7%	0.0%	0.3%	0.0%	0.0%	0.8%
No. of visits by surgeon	0.05	0.14	0.10	0.07	0.01	0.03	0.07	0.01	0.00	0.01
No. of visits by other MDs	6.28	14.47	21.16	14.52	16.29	14.19	10.59	7.58	7.78	11.90
Post-Operative Services, Out of Hospital:										
No. of visits by surgeon	0.00	0.01	0.13	0.00	0.01	0.00	0.01	0.03	0.07	0.01
No. of visits by other MDs	2.31	2.82	2.64	2.45	2.35	2.86	2.41	2.97	3.13	1.91

[a]Weighted means have been calculated across the six CABG codes (based on the number of bypass grafts), using national frequencies as weights

obstructions surgically. It is most likely that the angioplasty bills seen in Table 3-2 were for such angioplasty performed prior to the CABG operation.

Surgeons may also perform other types of surgical procedures during the CABG besides open heart operations. These other procedures would not be subject to the 50 percent discount rule, because they involve a separate incision. There is considerable variation in the frequency with which such other surgery is performed, from almost never (Portland) to almost 17 percent of all cases (Atlanta). As a rule, surgeons who are more likely to perform valve replacements and other open heart procedures simultaneously with the CABG also are apt to do other types of surgery as well. These other surgeries most commonly include carotid thromboendarterectomy, exploration of "other vessels", and saphenous vein stripping. This latter may simply be the removal of the vein graft for use in the CABG itself; if so, an additional bill should not have been allowed.

Assistant surgeons are never included in the surgeon's global fee. We explicitly show them in our analyses, however, because their use may enhance the surgeon's productivity; if an assistant allows the surgeon to finish faster, for example, then more time is available for subsequent operations. In the case of CABG surgery, however, assistant surgeons are <u>always</u> needed; more than one pair of hands is needed to obtain the graft and crack the chest. Why, then, do we observe so much variation across areas in the use of assistant surgeons? Four of the ten cities report that assistant surgeons were used in less than one-half of operations. The answer undoubtedly lies partly in the frequency with which residents in thoracic surgery serve as assistants. When a resident assists, no Part B bill is submitted; Medicare pays for their services through Part A. All of the ten cities shown on Table 3-2, however, have major teaching hospitals. In fact, a residency training program in thoracic surgery is offered in eight of them (although the size of the programs vary); Phoenix and Hartford are the two exceptions. Then why don't we observe low utilization rates for assistants during CABG surgery in these eight cities? Possible explanations may lie in the resident-to-operation workload, the availability of fee-for-service thoracic surgeons, etc. In our econometric work below, we will examine these factors more closely.

Visits consitute the service most commonly considered part of the surgeon's global fee. From Table 3-2, we see that, with the exception of Phoenix, there is little billing by surgeons on the day of surgery for any kind of visit. (Visits here and elsewhere on the table refer to all kinds of visits, regardless of location, as well as consultations.) If any bills are going to be submitted for a visit, they are apt to come from other physicians involved in the patient's care.

3.2.3 Pre-operative Services

Pre-operative services were defined as the seven days immediately prior to the CABG surgery. There is considerable variation in the propensity with which surgeons submit bills for preoperative visits: almost never in Birmingham, Kansas City, Portland, and Milwaukee, and most of the time in Atlanta. These bills were generally for consulations performed in the hospital.

Prospective patients were seen (and billed) often by other physicians, however. The number of such visits in a one week period typically averaged five, but ranged from three in Portland to seven in Hartford.

3.2.4 Postoperative Inpatient Services

Because we lacked Part A data, it was not possible to perfectly distinguish services provided postoperatively during the same hospital episode as the CABG from those provided during a readmission. As a result, our measures of postoperative hospital visits associated with CABG surgery are overestimated; some number of those visits may have been provided during a readmission and hence, would not have been included in the global fee. Most of the postoperative hospital visits shown in Table 3-2, however, were provided during the first 14 days after surgery and thus can be considered follow-up care for the CABG.

A small number of patients underwent surgery for post-operative hemmorhaging in the chest, a complication of the CABG procedure. Can we attribute variation in these rates to differences in surgical ability? It's possible, but most likely this area variation is due to differences in surgeons' willingness to submit bills for complications requiring additional surgery (or to differences in carriers' willingness to accept such bills).

Virtually all follow-up care provided by surgeons appears to be included in the global CABG fee. There are few visit bills in any of the ten MSAs. Other physicians, however, provide considerable inpatient care. Differences here in the number of visits probably reflect area differences in average length of hospital stay.

3.2.5 Postoperative Care, Out of Hospital

The out of hospital care includes all visits and consultations in any location (except inpatient) during the 90 days following surgery. Again, we observe virtually no visit bills submitted by the surgeons who performed the CABG operation. If care is being provided in their office, it appears to be considered part of the global fee.

There is surprisingly little variation in the number of ambulatory visits to other physicians across areas. The average CABG patient sees another physician two to three times during this time period.

3.2.6 Adjusting CABG Fees for Extra-Billing

Can we reduce the inter-area variation in CABG fees, by accounting for extra billing by the surgeon? The five areas in Table 3-3 represent the range of allowed charges, from the low of $2,985 in Birmingham to the high of $4,901 in Passaic-Bergen (New Jersey), a difference of 1.64 to one. Adjusting surgeons' fees by the Geographic Practice Cost Index reduces the difference considerably. The average allowed charge in Passaic-Bergen is now "only" 35 percent higher than that in Birmingham.

Each successive row in Table 3-3 adds in more services to provide a CABG fee adjusted for "extra billing". The additional dollars represent the average charge per patient for those services and have been deflated for practice cost differences. Adding in pre and postoperative visit billings by the surgeon makes virtually no difference in the Passaic-Bergen/Birmingham "charge gap".

Once we account for other open heart surgery performed at the same time as the CABG, however, the "gap" narrows substantially. Surgeons in the two least expensive MSAs on Table 3-3 more frequently perform valve replacements, adding to the total costs of surgery. They also are more likely to perform other surgical procedures during the CABG operation, but the dollar implications here are fairly small. Similarly, while Phoenix surgeons are more likely to bill for surgical treatment of post-operative complications, the added dollars are small on a per patient basis.

Besides visits, surgeons may provide other services to CABG patients either pre or postoperatively. Generally, these consist of diagnostic cardiac tests, ranging from ECGs to cardiac catheterization. Adding these services into the surgical fee does narrow the charge differential but only slightly.

Earlier we had postulated that surgeons' fees might be lower in areas with greater use of assistants at surgery. In the case of CABG surgery, where assistants are always required, we are actually measuring the use of private practice physicians as assistants. Because of the extensive use of private assistant surgeons in Passaic-Bergen, and the high fees they are paid, adding in assistant surgeons' bills increases the charge gap between Passaic-Bergen and Birmingham. For two of the other three cities, however, the relative charge differences are narrowed; there is now much less variation in the "true" charge for CABG surgery between Milwaukee and Phoenix.

TABLE 3-3

ADJUSTMENTS TO CABG FEES FOR EXTRA-BILLING[a]

	Passaic-Bergen	Milwaukee	Phoenix	Kansas City	Birmingham	Ratio of Highest to Lowest Area
Surgeon's Fee	$4,901	$4,150	$3,810	$3,086	$2,985	1.64
Surgeon's Fee (deflated)	4,240	3,948	3,632	3,276	3,138	1.35
Pre/Postoperative Visits by the Surgeon	4,264	3,949	3,687	3,283	3,140	1.36
Other Open Heart Surgery[b]	4,266	4,094	3,691	3,441	3,356	1.27
Other Surgical Procedures on Same Day[b]	4,276	4,128	3,718	3,492	3,396	1.26
Surgery for Post-Operative Complications[b]	4,276	4,133	3,741	3,502	3,402	1.26
Other Pre/Post-Operative Services by Surgeon	4,301	4,227	3,840	3,584	3,429	1.25
Assistant Surgeons	5,001	4,310	4,389	4,185	3,639	1.37

[a]Weighted means have been calculated across six CABG codes (based on the number of bypass grafts inserted), using national frequencies as weights.

[b]The majority of these procedures were performed by the CABG surgeon.

Source: Medicare Part B Claims, 1986.

3.2.7 Explaining Variation in CABG Fees

In the previous section, we attempted to adjust average CABG fees for any extra-billing for pre and postoperative visits, concomitant surgical procedures, etc. The table was limited, however, to only five market areas (although representing a wide range in allowed charges). Inclusion of more market areas would have made the comparisons too unwieldy. The adjusted fees are also sensitive to the order in which the adjustments are made. In order to gain a better understanding of the impact of extra-billing, utilizing all markets, we estimated regressions with the allowed charge as the dependent variable. In the regression work, the individual operation is the unit of observation rather than the market area.

Four groups of independent variables were included:

(1) the Geographic Practice Cost Index;

(2) the number of bypass grafts inserted, specified as dummy variables for two, three, four, five, and six or more grafts, respectively, with one graft as the omitted category;

(3) global fee variables, including a dummy variable if other open heart surgery was performed at the same time; a dummy variable if any other surgery was performed at the same time; the number of visits provided by the surgeon on the day of surgery, preoperatively, and postoperatively, respectively; a dummy variable if a bill was submitted for an assistant surgeon; and a dummy variable if the surgeon submitted a bill for additional surgery for postoperative complications; and

(4) market area characteristics, including surgeons per 10,000 population; hospital beds per 10,000; per capita income; and the percent of population white.

Table 3-4 presents the regression results, along with means for the independent variable. As expected, allowed charges are highly sensitive to variations in the GPCI. CABG charges are 15 percent greater in areas where the cost of practice is ten percent higher than average, even after holding constant area characteristics like the supply of surgeons and any extra-billing.* In fact, practice cost differences alone explain over one-half (56 percent) of the variation in CABG fees, as measured by the R-square when only GPCI is included in the equation.

Since carriers include procedure code in their charge screens, we would expect the average CABG charge to increase as the number of grafts increased. This is, in fact, the case; inserting a second graft raises the base CABG charge by $559, a third graft an additional $396 (955-559), etc. In fact, the marginal "cost" of each additional graft declines steadily, partly because the

*The elasticity for GPCI is 1.49.

TABLE 3-4

EXPLAINING VARIATION IN CABG FEES

	Mean	Coefficient
GPCI	0.997	5,606.85***
Number of Grafts Inserted:		
One (omitted category)	0.074	--
Two	0.154	558.97***
Three	0.320	955.17***
Four	0.296	1,143.62***
Five	0.121	1,235.81***
Six or More	0.035	1,303.10***
Other Surgery at Same Time:		
Other Open Heart Surgery	0.070	-578.99***
All Other Surgery	0.043	-78.73***
Number of Same Day Visits	0.092	29.84**
Number of Preop Visits	0.501	80.11***
Number of Postop Visits	0.533	2.61*
Reoperation for Complications	0.010	-68.02
Assistant Surgeon	0.557	-39.47***
Surgeons Per Capita	0.560	22.19
Beds Per Capita	4.628	14.13***
Per Capita Income (000's)	13.220	16.45***
Percent Population White	84.573	9.87***
Constant	--	-3,862.56***
R^2	--	0.56
F-ratio	--	1,211.04***
df	--	16,0885

***Significant at one percent level.

**Significant at five percent level.

*Significant at ten percent level.

Source: Medicare Part B Claims, 1986.

marginal time asssociated with each graft is also falling (Cromwell et al., 1987). Even still, these added costs are significantly different from each other (based on a test of the respective regression coefficients), e.g., a five-bypass operation is significantly more expensive than one with only four grafts.

The CABG fee is definitely "discounted", by $579 on average, when other open heart surgery is performed at the same time. Given that the Medicare rule is a 50 percent reduction on the second surgery, how do we explain such a small discount (only 15 percent of the average CABG bill)? The reason is that it is not always the CABG fee which has been discounted but the fee for the other operation instead. Thus, in some (unknown) number of cases of concomitant open heart surgery, we are observing the full CABG fee.

Performance of other surgery during the same operative session also reduces the surgeon's fee, but by a much smaller amount: $79. These other operations typically included such procedures as transvenous pacemaker insertion and carotid thromboendarterectomy, as well as ones which could be considered truly complementary with the CABG surgery itself, e.g., saphenous vein stripping.

We had hypothesized that the surgeon's fee would be higher when more pre/postoperative visits were included in the global fee, as measured by fewer bills being submitted by the surgeon. If extra-billing is, in fact, offset by lower fees, then the coefficients associated with the three visit variables should all be negative. Instead, they are all positive, although the coefficient associated with the number of postoperative visits is significant only at the ten percent level. Patients receiving a bill from their surgeon for a visit during the week prior to surgery also pay $80 more for the operation itself, for example. One ex post explanation is that carriers have been more successful in obtaining a more comprehensive bundle of services in areas where fees are also lower. This is a plausible scenario in areas with relatively greater competition for cardiac patients. This is clearly an area that merits further research, as the possibility that higher fees are accompanied by more unbundling is an undesirable one from policymakers' perspective.

Sometimes a bypass graft fails or something else goes wrong and the patient is returned to the operating room for surgery to correct the complications. In these cases, the surgeon may or may not submit a bill for the re-operation. We had hypothesized that the surgeon who implicitly includes such treatment in his (her) global fee would have lower fees on average. Although the sign on the coefficient associated with this variable is negative as expected, it is not significant at conventional levels (t=1.44).

Medicare payment rules for surgery do not take into account whether or not an assistant surgeon was used; these assistants are reimbursed independently. Nevertheless, the use of assistant surgeons may raise the primary surgeon's productivity if operating time is shortened. Furthermore,

the use of assistant surgeons raises the cost of surgery to Medicare and the patient, as they are liable for this bill as well. (This is not true when residents serve as assistants, as no Part B bill is submitted.) Both of these factors would suggest lower CABG fees when assistant surgeons are employed. This does, in fact, appear to be the case; the use of non-resident assistants during CABG surgery reduces fees, *ceteris paribus*. However, while statistically significant, the $39 reduction is not very meaningful in real terms; it represents a saving of only one percent which is more than offset by the average bill of $750 from the assistant him/herself.

Since CABG surgery *always* requires at least one assistant, furthermore, the absence of a bill more likely indicates that surgical residents provided the assistance. If so, then the negative coefficient for this variable might reflect lower fees for surgeons practising in teaching hospitals.

The relative supply of surgeons has no apparent impact on CABG charges, *ceteris paribus*. In part, this may be because there are two offsetting hypotheses. First, in areas with greater surgeon density, competition for patients should drive fees down. On the other hand, surgeons are attracted to areas with greater demand, as evidenced by higher fees. Certainly, the other three variables which measure the demand for surgery are all positive and highly significant. CABG fees are higher in areas with relatively more hospital beds, higher incomes, and a greater proportion of population who are white (the latter may be proxying greater insurance coverage).

3.3 Permanent Transvenous Pacemaker Insertion

3.3.1 The Surgeon's Fee

The average allowed charges for pacemaker insertion for each market area are shown in Table 3-5. Surgeons' fees vary considerably, ranging from only $585 in Portland, Oregon to $1,430 in Middlesex-Somerset, New Jersey. Adjusting for geographic practice cost differences actually widens the charge "gap" somewhat; the average charge in the most expensive area (Albany, Georgia) is over one and a half times higher than that in the least expensive area (Milwaukee).

Unlike CABG surgery, pacemaker insertions can be performed in non-metropolitan areas. The effect of the practice cost adjustment is to raise fees for surgeons practising in rural areas relative to those of their colleagues in MSAs.

For greater comparability, we focus on each state's largest MSA in Table 3-6. Because Portland and Milwaukee are both characterized by exceptionally low fees, there is just as much variation across these 10 MSAs as across all of the market areas shown earlier. Even after adjustment for practice costs, surgeons are paid more than twice as much for the average pacemaker insertion in Atlanta as they are in Milwaukee.

TABLE 3-5

MEAN MEDICARE ALLOWED CHARGES FOR PACEMAKER INSERTION BY MARKET AREA, 1986[a]

	n	Actual	Deflated by GPCI
Alabama			
Birmingham	429	$1,012	$1,064
Florence	56	1,026	1,231
Mobile	145	981	1,106
Montgomery	105	1,119	1,296
Rural	144	946	1,169
Arizona			
Phoenix	488	1,177	1,122
Tucson	152	1,131	1,125
Rural	53	1,041	1,125
Connecticut			
Bridgeport	87	961	888
Stamford	79	784	725
Hartford	241	1,058	977
New Haven	120	1,012	1,048
Waterbury	67	1,033	1,071
Rural	56	1,066	1,110
Georgia			
Atlanta	492	1,133	1,222
Columbia-Richland	262	1,074	1,198
Albany	56	1,126	1,425
Columbus	59	1,007	1,139
Macon	121	1,068	1,316
Savannah	97	1,100	1,270
Rural	418	994	1,280
Kansas			
Kansas City	541	1,057	1,122
Topeka	95	998	1,120
Wichita	255	979	986
Rural	204	972	1,235

TABLE 3-5 (cont'd)

MEAN MEDICARE ALLOWED CHARGES BY PACEMAKER INSERTION BY MARKET AREA, 1986[a]

	n	Actual	Deflated by GPCI
New Jersey			
Passaic-Bergen	441	1,410	1,220
Jersey City	96	1,348	1,319
Middlesex-Somerset	324	1,430	1,233
Monmouth	276	1,191	1,004
Newark	891	1,388	1,171
(Philadelphia)	381	1,307	1,228
Trenton	177	1,377	1,252
Oklahoma			
Oklahoma City	534	959	1,061
Tulsa	331	1,026	1,113
Rural	151	906	1,133
Oregon			
Portland	191	585	579
Eugene	61	820	826
Medford	59	753	746
Salem	68	729	826
Rural	87	710	790
Washington			
Seattle	389	865	774
Spokane	150	979	1,037
Tacoma	120	955	920
Yakima	56	812	941
Rural	177	919	929
Wisconsin			
Milwaukee	118	592	563
Madison	335	719	756
Rural	52	677	798
All Areas	10,287	996	1,044
Ratio of Highest to Lowest Charge Areas		2.44	2.54

[a]Weighted means have been calculated across three pacemaker codes (atrial, ventricular and AV-sequential), using national frequencies as the weights.

Source: Medicare Part B Claims, 1986.

TABLE 3-6

SURGEONS' FEES AND PRACTICE PATTERNS FOR PERMANENT PACEMAKER INSERTION: A TALE OF TEN CITIES[a]

	Birmingham AL	Phoenix AZ	Hartford CT	Atlanta GA	Kansas City KA	Newark NJ	Oklahoma City OK	Portland OR	Seattle WA	Milwauk WI
Surgeon's Fee	$1,012	$1,177	$1,058	$1,133	$1,057	$1,388	$959	$585	$865	$592
Surgeon's Fee (deflated)	$1,064	$1,122	$977	$1,222	$1,122	$1,171	$1,061	$579	$774	$563
Specialty Mix:[b]										
General Surgeon	18.9%	5.5%	3.7%	13.6%	3.6%	21.3%	4.5%	13.1%	40.4%	11.0
Cardiologist	19.6%	38.3%	72.6%	23.4%	39.8	9.4%	36.3%	83.8%	54.3%	40.6
Thoracic Surgeon	61.5%	56.2%	17.0%	59.6%	56.4	55.2%	59.2%	3.1%	2.8%	44.2
Multi-Specialty Group	0.0%	0.0%	6.6%	3.5%	0.2	14.1%	0.0%	0.0%	2.5%	4.2
Same Day Services:										
% with second pacemaker bill	0.5%	5.8%	7.1%	2.2%	4.8%	7.6%	1.5%	12.7%	7.2%	68.7
% with assistant surgeon for the pacemaker	0.0%	3.3%	1.4%	1.2%	0.0%	19.5%	1.7%	3.5%	10.4%	0.0
% with cardiac surgery/cath.	2.7%	0.6%	2.2%	0.6%	1.1%	0.2%	2.1%	1.1%	2.5%	1.5
% with other surgery	1.8%	0.8%	1.3%	1.3%	1.5%	0.7%	0.7%	0.0%	0.8%	0.8
No. of visits by surgeon	0.01	0.50	0.16	0.37	0.13	0.25	0.27	0.43	0.22	0.0
No. of visits by team MD	0.00	0.04	0.04	0.02	0.02	0.09	0.03	0.06	0.06	0.0
No. of visits by other MDs	0.64	1.12	0.74	0.98	1.02	0.75	0.78	0.44	0.64	0.4
Pre-Operative Services:										
No. of visits by surgeon	0.45	0.64	0.97	1.07	0.44	0.81	0.71	1.30	0.78	0.5
No. of visits by team MD	0.00	0.04	0.00	0.02	0.00	0.44	0.05	0.15	0.11	0.1
No. of visits by other MDs	6.21	3.69	7.22	3.54	4.00	3.26	2.71	2.15	2.49	3.5
Post-Operative Services, In Hospital:										
No. of visits by surgeon	0.44	0.57	0.32	0.60	0.42	0.53	1.63	2.00	0.83	0.5
No. of visits by team MD	0.00	0.09	0.12	0.06	0.04	0.54	0.12	0.09	0.28	0.8
No. of visits by other MDs	8.05	7.91	8.93	8.51	8.23	9.68	7.80	3.11	5.18	3.4
% with repeat pacemaker	0.7%	0.7%	3.0%	2.7%	1.7%	2.6%	0.4%	4.7%	5.6%	2.
% with pacemaker repair	3.1%	2.4%	1.6%	2.0%	1.7%	2.4%	0.8%	3.6%	0.8%	3.
Post-Operative Services, Out of Hospital:										
No. of visits by surgeon	0.19	0.27	0.19	0.19	0.19	0.09	0.35	0.82	0.63	0.
No. of visits by team MD	0.00	0.02	0.03	0.01	0.02	0.17	0.04	0.14	0.08	0.
No. of visits by other MDs	2.29	2.60	2.00	2.33	2.40	1.95	2.03	1.98	2.78	1.

[a]Weighted means have been calculated across the three pacemaker codes, using national frequencies as weights.

[b]Specialty percents sum to 100% by column.

Source: Medicare Part B Claims, 1986.

One explanation for fee variation may lie in area differences in specialty mix. Unlike CABG surgery in which the operation is performed only by a thoracic surgeon, pacemakers may be inserted by general surgeons, cardiologists, or thoracic surgeons. Sometimes a team approach is used, a point we return to below. From Table 3-6, we observe that there is considerable specialty variation; cardiologists, rather than surgeons, insert the majority of pacemakers in Hartford, Portland, and Seattle, for example. The potential dollar implications of these different practice styles will be examined later.

3.3.2 Variation in "Same Day" Services

Under the team approach to pacemaker insertion, a surgeon makes the "pocket" to hold the device and a cardiologist threads the electrodes. Although this may be a clinically more efficient method, the problem arises in how to pay for it. Neither physician is serving as an assistant surgeon; each is performing a portion of the procedure. As the prevalence of the team approach varies around the country, carriers have developed different ways of identifying and paying for it. Some carriers accept two bills for pacemaker insertion (both with surgery designated as the type of service), and adjust the fee paid to each physician so as not to pay twice.* Another method is for the second bill to be coded as a pacemaker "repair", e.g., insertion or replacement of pulse generator only, or of the electrodes only.** Finally, some carriers expect one of the two physicians to bill as an assistant. Pacemaker insertion is one of the few operating room procedures in which an assistant is almost never technically necessary, so an assistant surgeon bill generally indicates the team approach. The problem with all of these payment methods is that they can lead to erroneous conclusions regarding the extent of geographic fee variation. In areas where the team approach is commonly employed, a single physician's fee could grossly understate the true physician charge for pacemaker insertion.

Table 3-6 illustrates the area diversity in which these different approaches are used: the percent of cases with a second pacemaker bill (either for insertion or for repair), and the percent with an assistant specifically for the pacemaker. Most strikingly, physicians in Milwaukee with their exceptionally low fees have a second physician involved in two-thirds of all pacemaker procedures. The team approach alone, however, can not explain the geographic disparity in fees. Fees in Oregon, for example, average even

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*Ideally, these bills would have a modifier indicating that two surgeons were involved but in practice this usually does not happen.

**One carrier states that both physicians are supposed to use repair codes. In this case, we will have underestimated the total number of pacemaker insertions in that state. (We identified cases by the presence of a bill with an insertion code of 33206, 33207, or 33208.)

less than those in Milwaukee, but physicians there use a second physician in only 16 percent of cases. Newark fees, on the other hand, are among the highest in our ten states, yet their physicians receive some form of assistance in one-fourth of all cases. Interestingly, in one-quarter of these team approaches, the two physicians are members of the same group practice.

Permanent pacemakers are sometimes inserted at the same time when another operation is being performed, but the area variation is minimal. When another operation is involved, it is generally CABG surgery.

As a rule, we see that pacemaker surgeons are more likely to bill patients for same day visits than are CABG surgeons. This is probably due to carrier variation in the bundling rules for pacemakers. The second team physician (where one is involved) accounts for little additional same day billing.

3.3.3 Pre- and Postoperative Services

Many, if not most, prospective patients, are billed by the physician who will be implanting their pacemaker, generally for an in-hospital consultation. When we add in the second physician's billings, the number of such contacts increase considerably, especially in Newark and Milwaukee. When the team physician bills as an assistant or for pacemaker repair (rather than insertion), carriers may well not apply the same global fee rules as they do for the basic procedure. It does not seem appropriate, however, to treat team physicians differently from the "go it alone" surgeon. There also appears to be considerable billing for postoperative visits outside the global fee. Counting team physician billings, the average pacemaker patient is billed for at least one postoperative hospital visit in Newark, Oklahoma City, Portland, and Milwaukee. Postoperative ambulatory visit billings are considerably smaller, although the typical pacemaker patient in Portland is billed for one visit from a physician involved in their implant.

A small proportion of patients will need their pacemakers repaired, or replaced entirely, during the 90-day period following implantation. A repeat procedure is required for 5 percent of patients in Portland and Seattle. Repairs are needed in over 3 percent of cases in Birmingham, Portland, and Milwaukee. To our knowledge, no carriers prohibit billing for these repairs and re-implantations; however, policymakers might consider a warranty arrangement for pacemakers in which the physician remains responsible for maintenance.

3.3.4 Adjusting the Fee for a Team Approach and for Extra-Billing

In the case of pacemaker insertion, it is clear that a fee represented by a single bill does not adequately represent the "true" charge when a team approach is employed. In this section, we seek to reduce the inter-area

variation in pacemaker fees, by accounting for team bills and then for extra billing by all physicians involved in the implantation procedure.

The five areas in Table 3-7 represent a range in allowed charges, from the low of $592 in Milwaukee to the high of $1,410 in Passaic-Bergen (New Jersey). Adjustment for practice cost differences narrows the charge gap, but substantial variation remains. Atlanta fees, furthermore, are now as high as those in Passaic-Bergen. From this point on, we will use the MSA with the highest fee (either Passaic-Bergen or Atlanta) in our calculation of the ratio of the highest to lowest charge areas.

Because fees may vary because of area differences in the specialty of the physician inserting the pacemaker, we made a further adjustment. New weighted means were calculated, using national specialty frequencies to weight each specialty's average fee in its market area. Because thoracic surgeons generally receive higher payments than either general surgeons or cardiologists, areas with relatively low use of thoracic surgeons (like Seattle) experienced upward ajustments in their mean allowed charge. The specialty adjustment made only a small reduction in the <u>range</u> in fees across the five areas, however.

Adjusting for the use of a team approach to pacemaker insertion has a dramatic impact on the variation in fees. The ratio of the most expensive to least expensive areas falls from 2.13 to 1.52. Although Passaic-Bergen charges are adjusted upwards by over $100 (because of extensive use of assistant surgeons), the average charge in Milwaukee increases over 50 percent (an added $294) when we add in team physician billings. Although billings for pre and postoperative visits by the primary surgeon have little effect on total pacemaker charges, adding in comparable bills for team physicians narrows the charge "gap" even further. The average charge in Passaic-Bergen is now "only" 48 percent greater than that in Milwaukee, compared with 138 percent before any adjustments were made.

Finally, there does not seem to be any implicit warranty in pacemaker fees. Taking replacements and repairs into account has no effect on the charge differential across areas.

3.3.5 <u>Explaining Variation in Pacemaker Insertion Fees</u>

The pacemaker regression specification is basically similar to that for CABG surgery. Since pacemakers may be inserted by physicians of different specialties, we also include specialty dummy variables.

As before, the geographic cost of practice index has a major impact on charge levels (see Table 3-8). The elasticity associated with the GPCI coefficient implies that a 10 percent increase in relative practice costs will raise fees by 12.6 percent, <u>ceteris paribus</u>. Practice cost differences are

TABLE 3-7

ADJUSTMENTS TO PACEMAKER FEES FOR A TEAM APPROACH AND FOR EXTRA-BILLING[a]

	Passaic-Bergen	Atlanta	Hartford	Seattle	Milwaukee	Ratio of Highest to Lowest Area
Surgeon's Fee	$1,410	$1,133	$1,058	$865	$592	2.38
Surgeon's Fee (deflated)	1,220	1,222	977	774	563	2.17
Surgeon's Fee (specialty-adjusted)	1,195	1,208	962	843	562	2.13
Team Approach	1,299	1,221	982	887	856	1.52
Pre/Post-Operative Visits by the Surgeon	1,399	1,340	1,056	963	913	1.53
Pre/Post-Operative Visits by Team Physician	1,433	1,345	1,062	976	969	1.48
Repeat Pacemakers and Repairs	1,483	1,370	1,096	1,001	995	1.49

[a]Weighted means have been calculated across the three pacemaker codes, using national frequencies as weights.

Source: Medicare Part B Claims, 1986.

TABLE 3-8

EXPLAINING VARIATION IN PACEMAKER INSERTION FEES

	Mean	Coefficient
GPCI	0.994	1,375.79***
Type of Device:		
Atrial (omitted category)	0.305	--
Ventricular	0.501	62.22***
A-V Sequential	0.194	258.79***
Team Approach	0.133	-55.39***
Specialty:		
General Surgeon	0.233	-108.43***
Cardiologist	0.304	-115.43***
Multi-Specialty Group	0.051	-144.23***
Thoracic Surgeon (omitted category)	0.412	--
Other Surgery at Same Time	0.020	-171.01***
Number of Same Day Visits	0.264	16.15***
Number of Preop Visits	0.907	7.98***
Number of Postop Visits	1.195	-3.63***
Physicians Per Capita	1.981	-96.10***
Beds Per Capita	4.663	12.11***
Per Capita Income (000's)	13.299	34.40***
Percent Population White	83.844	-7.87***
Constant	--	36.51
R^2	--	0.46
F-ratio	--	589.84***
df	--	10,271

***Significant at one percent level.

Source: Medicare Part B Claims, 1986.

less important in explaining fee variation for pacemaker insertion than they were for CABG surgery; the explanatory power of the equation when only GPCI is included was only 18 percent (compared with 56 percent for CABG fees).

The procedure code dummy variables included in the pacemaker regression capture the type of device actually inserted. Insertion of a ventricular pacemaker raises fees by $62 relative to the simpler atrial device, and use of the considerably more complex A-V sequential pacemaker increases the bill by $259. This is consistent with the longer operating time reported by physicians for the A-V sequential device (Mitchell et al.,1988).

Unlike almost any other surgery, two physicians are sometimes involved performing the same tasks (creation of the "pocket" and placement of the electrodes) that otherwise are done by a single physician during pacemaker insertion. Carriers vary considerably in how they identify and reimburse for pacemakers inserted by a two-physician team versus a solo practitioner. Since our dependent variable represents only a single physician's bill, we included a dummy variable if a team approach was used.* When one physician inserts a pacemaker in conjunction with another, his/her fee is significantly lower, but only by $55 (about 5 percent of the average pacemaker bill). When a second physician also bills, however, that physician's bill is considerably higher, $363 on average; thus, the net impact on the total cost of surgery is positive and quite large.**

Thoracic surgeons have the highest allowed charges for pacemaker insertion of any specialty, receiving over $100 more for the same operation. Fees are lowest in multi-specialty groups where average charges are $30-35 below those of cardiologists and general surgeons. (The fees of these latter two specialties are not statistically different from each other, based on a test of their regression coefficients.)

Other surgery is performed only infrequently at the time of pacemaker insertion. When it is done, however, the pacemaker fee is "discounted" substantially, by $171 or about 17 percent.

Physicians definitely appear to compensate for lower fees by billing for more postoperative visits, rather than including them in their global fee. The pacemaker fee is reduced by $3.63 for each postoperative visit billed for separately. Physicians billing for preoperative and same day visits, however, actually have higher charges than do their colleagues (who either have included these visits in their global fees or simply have not provided them).

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*It is not possible to identify the team method from any single physician's bill. Instead, we defined the use of a team as those cases in which a second pacemaker insertion bill was submitted, a bill for (same day) pacemaker repair, or a bill for assistance in pacemaker insertion.

**We know that in Wisconsin, where average pacemaker fees are considerably less than those of other states, the team approach is commonly used. Even here, however, the team approach is 38 percent more expensive than when a single physician performs the entire procedure ($1,036 versus $753).

Areas with a relatively greater supply of physicians have significantly lower fees, suggesting that competitive effects dominate. The associated elasticity is very low, however; a one percent increase in physicians per capita reduces fees by only 0.13 percent. As expected, pacemaker fees are higher in areas where the demand for care is greater, as measured by higher per capita incomes and a greater supply of hospital beds. Surprisingly, fees are lower in areas with a disproportionately larger white population.

3.4 Carotid Thromboendarterectomy

3.4.1 The Surgeon's Fee

Mean allowed charges for thromboendarterectomy are shown in Table 3-9 for each market area. Surgeons' charges vary by a factor of two, ranging from $1,005 in Huntsville, Alabama to $2,030 in Monmouth, New Jersey. Adjusting for geographic cost of practice differences actually widens the charge "gap"; the average charge in the most expensive area (Atlantic City, New Jersey) is 127 percent higher than that in the least expensive area (still Huntsville).

Again, for greater comparability, we display the largest MSA for each state in Table 3-10. There is less variation across these MSAs than across all market areas performing thromboendarterectomy, especially after practice cost adjustment. Even still, the average deflated bill for this operation in Phoenix and Atlanta is over $600 higher than a bill for comparable surgery in Birmingham.

Area differences in specialty mix may be one factor in these fee variations. Three specialties commonly perform carotid thromboendarterectomy: general surgery, neurosurgery, and thoracic surgery. From Table 3-10, we see that there are considerable differences; while neurosurgeons generally account for a small portion of cases, they perform one-third of all operations in Portland. In Phoenix, Hartford, and Oklahoma City, almost all of the procedures are performed by thoracic surgeons, while this operations is the province of general surgeons in Seattle. Later we will analyze the dollar implications of these specialty differences.

3.4.2 Variation in "Same Day" Services

There is considerable variation in the frequency with which other surgery is performed in conjuntion with carotid thromboendarterectomy (see Table 3-10). Surgeons in Phoenix, Oklahoma City, and Portland infrequently combine this operation with another, possibly because they are discourgaged by the carrier from doing so (they are all served by the same carrier). By contrast, surgeons in five of the 10 MSAs perform other surgery in over ten

TABLE 3-9

MEAN MEDICARE ALLOWED CHARGES FOR CAROTID THROMBOENDARTERECTOMY BY MARKET AREA, 1986

	n	Actual	Deflated by GPCI
Alabama			
Tuscaloosa	61	$1,022	$1,067
Birmingham	513	1,019	1,071
Huntsville	98	1,005	924
Mobile	224	1,017	1,147
Montgomery	104	1,031	1,194
Rural	94	1,026	1,268
Arizona			
Phoenix	455	1,790	1,706
Tucson	118	1,853	1,844
Connecticut			
Hartford	138	1,395	1,288
New Haven	120	1,742	1,805
Georgia			
Atlanta	566	1,582	1,707
Columbus	52	1,338	1,514
Macon	121	1,326	1,633
Savannah	94	1,532	1,769
Rural	372	1,559	2,006
Kansas			
Kansas City	372	1,458	1,548
Topeka	380	1,500	1,683
Wichita	283	1,510	1,520
Rural	195	1,494	1,898
New Jersey			
Atlantic City	68	1,941	2,094
Passaic-Bergen	176	1,890	1,635
Middlesex-Somerset	138	1,936	1,669
Monmouth	209	2,030	1,712
Newark	250	1,870	1,578
(Philadelphia)	199	1,805	1,695
Trenton	86	1,897	1,725

TABLE 3-9 (cont'd)

MEAN MEDICARE ALLOWED CHARGES FOR CAROTID THROMBOENDARTERECTOMY BY MARKET AREA, 1986

	n	Actual	Deflated by GPCI
Oklahoma			
Oklahoma City	219	1,519	1,681
Tulsa	205	1,568	1,592
Rural	55	1,309	1,636
Oregon			
Portland	355	1,633	1,617
Eugene	155	1,444	1,454
Medford	83	1,482	1,469
Salem	108	1,487	1,684
Rural	188	1,503	1,672
Washington			
Seattle	535	1,585	1,418
Olympia	52	1,509	1,598
Spokane	241	1,671	1,610
Tacoma	120	1,672	1,689
Rural	173	1,295	1,468
Wisconsin			
Appleton-Oshkosh	84	1,295	1,468
Milwaukee	248	1,227	1,167
Green Bay	72	1,282	1,334
Madison	338	1,292	1,357
All Areas	8,407	1,502	1,548
Ratio of Highest to Lowest Charge Areas		2.02	2.27

Source: Medicare Part B Claims.

TABLE 3-10

SURGEONS' FEES AND PRACTICE PATTERNS FOR CAROTID THROMBOENDARTERECTOMY: A TALE OF TEN CITIES[a]

	Birmingham AL	Phoenix AZ	Hartford CT	Atlanta GA	Kansas City KA	Newark NJ	Oklahoma City OK	Portland OR	Seattle WA	Milwaukee WI
Surgeon's Fee	$1,019	$1,790	$1,395	$1,582	$1,458	$1,870	$1,519	$1,633	$1,585	$1,227
Surgeon's Fee (deflated)	1,071	1,706	1,288	1,707	1,548	1,578	1,681	1,617	1,418	1,167
Specialty Mix:[a]										
General Surgeon	48.3%	16.4%	6.3%	66.3%	45.0%	39.2%	14.2%	57.2%	88.8%	50.8%
Neurosurgeon	6.6%	11.6%	2.4%	3.2%	4.2%	6.0%	10.0%	32.4%	0.9%	2.8%
Thoracic Surgeon	45.0%	72.0%	90.4%	30.5%	50.8%	41.2%	75.8%	10.4%	6.7%	42.0%
Multi-Specialty Group	0.0%	0.0%	0.9%	0.0%	0.0%	13.6%	0.0%	0.0%	3.6%	4.4%
Same Day Services:										
% with other surgery	13.8%	2.4%	11.1%	10.6%	12.4%	5.2%	2.3%	2.0%	5.6%	11.7%
% with assistant surgeon	20.9%	42.9%	19.1%	72.1%	51.8%	51.6%	80.8%	57.2%	74.4%	33.9%
No. of visits by surgeon	0.08	0.04	0.02	0.04	0.06	0.07	0.02	0.19	0.03	0.00
No. of visits by other MDs	0.39	0.94	1.07	1.02	0.91	0.99	0.52	0.43	0.41	0.41
Pre-Operative Services:										
No. of visits by surgeon	0.36	1.07	0.59	1.36	0.27	0.61	0.66	0.68	0.25	0.24
No. of visits by other MDs	3.07	2.04	3.29	2.66	2.84	2.42	2.58	1.43	1.24	3.92
Post-Operative Services, In Hospital:										
% with repeat surgery	9.2%	10.1%	7.9%	9.4%	10.8%	9.2%	9.6%	10.7%	6.5%	7.7%
No. of visits by surgeon	0.21	0.36	0.07	0.35	0.07	0.33	0.16	0.04	0.23	0.24
No. of visits by other MDs	5.63	7.72	6.25	9.43	9.67	8.78	7.03	4.27	4.22	7.55
Post-Operative Services, Out of Hospital:										
No. of visits by surgeon	0.04	0.06	0.14	0.01	0.07	0.06	0.01	0.03	0.10	0.13
No. of visits by other MDs	1.95	1.99	1.75	1.50	1.83	1.92	2.18	2.04	2.14	1.67

[a]Specialty percents sum to 100% by column.

percent of all thromboendarterectomy operations. Most frequently, this other surgery consists of coronary artery bypass grafts, or bypasses of other arteries.

While assistant surgeons should be more frequently used when additional operations are being performed, there does not seem to be any relationship between the prevalence of other surgery and the use of assistant surgeons. Birmingham surgeons, for example, combine other surgery in almost 14 percent of all thromboendarterectomy procedures, but use a (non-resident) assistant in only one-fifth of all cases. Almost all patients in Atlanta, Oklahoma City, and Seattle, on the other hand, receive a bil for an assistant surgeon.

Surgeons generally do not bill patients for visits on the day of the operation. Portland surgeons are an exception; they bill about one-fifth of their patients.

3.4.3 Pre-and Postoperative Services

There appears to be relatively little bundling of preoperative visits or consultations in most MSAs. Patients in Phoenix and Atlanta are billed for at least one contact in the week prior to surgery. The majority of patients in Hartford, Newark, Oklahoma City, and Portland are billed once, usually for an in-hospital consultation.

Postoperative visits, on the other hand, are more likely to be included in the surgeon's global fee. This is particularly true for ambulatory visits. Recall that we probably overestimate the billing of postoperative hospital visits, as we can not reliably distinguish readmissions from the index episode.

A surprising number of patients in all ten MSAs have a repeat carotid thromboendarterectomy. It is almost always performed by the same surgeon. One-half of all repeat operations take place within three weeks of the initial procedure, and three-quarters within six weeks.

3.4.4 Adjustments for Extra-Billing

The five MSAs in Table 3-11 represent the range of allowed charges for carotid thromboendarterectomy, from the low of $1,019 in Birmingham to the high of $1,936 in Middlesex-Somerset, New Jersey (including New Brunswick), a difference of 1.90 to one. Adjusting for practice cost differences reduces the range considerably; Phoenix is now the most expensive of these five MSAs and will remain so even after adjustment for extra-billing.

Adjusting for specialty mix narrows the range in fees somewhat. This procedure is more frequently performed by thoracic surgeons in Oklahoma City relative to the nation as a whole; the effect of the specialty adjustment thus is to lower the average allowed charge in this MSA.

TABLE 3-11

ADJUSTMENTS TO CAROTID THROMBOENDARTERECTOMY FEES FOR EXTRA-BILLING

	Middlesex-Somerset	Phoenix	Oklahoma City	Milwaukee	Birmingham	Ratio of Highest to Lowest Area
Surgeon's Fee	$1,936	$1,790	$1,519	$1,227	$1,019	1.90
Surgeon's Fee (deflated)	1,669	1,706	1,681	1,167	1,071	1.59
Surgeon's Fee (specialty adjusted)	1,631	1,661	1,590	1,174	1,075	1.55
Pre/Postoperative Visits by the Surgeon	1,703	1,740	1,626	1,197	1,099	1.58
Other Surgical Procedures on Same Day by the Surgeon	1,751	1,785	1,636	1,521	1,287	1.39
Other Pre/Postoperative Services by the Surgeon	1,989	2,117	1,899	1,792	1,432	1.48
Assistant Surgeon	2,258	2,260	2,064	1,879	1,529	1.48

Source: Medicare Part B Claims, 1986.

Adjusting for pre and postoperative visits billed by the surgeon does not narrow the charge "gap", but actually widens it somewhat. Surgeons in the two most expensive MSAs (Phoenix and Middlesex-Somerset) actually are more likely to submit such bills, especially for preoperative hospital visits. Surgeons in the two least expensive MSAs (Birmingham and Milwaukee), on the other hand, are more apt to perform other surgery at the same time. Adding in their charges for these procedures reduces the charge differential considerably.

Surgeons performing carotid thromboendarterectomoy submit fairly large bills for other services (in addition to visits) provided to patients either pre- or postoperatively. Adding these services into the total widens the charge "gap", as high fee areas also have greater utilization of these other services. These other bills ranged from $145 (deflated dollars) in Birmingham to $332 in Phoenix. Procedure-specific detail was not retained, so we can not precisely identify these services. About one-third was for preoperative services; the bulk of the remainder was for postoperative <u>inhospital</u> care. It is possible that charges for subsequent surgery are included here, but bills for repeat thromboendarterectomy are specifically <u>excluded</u>.

Finally, we add in bills for assistant surgeons. Since patients undergoing two operations at the same time are more likely to have an assistant, we include here only those bills specifically for assistance with the thromboendarterectomy. The charge "gap" remains unchanged.

3.4.5 <u>Explaining Variation in Carotid Thromboendarterectomy Fees</u>

Table 3-12 present regression results for carotid thromboendarterectomy that are similar in specification to those shown earlier for CABG and pacemaker surgery. While the coefficient associated with the GPCI variable is highly significant, thromboendartecomy fees are somewhat less sensitive to practice cost differences compared with fees for the other two cardiovascular procedures. Thromboendarterectomy charges are 7.5 percent greater in areas where the cost of practice is ten percent higher than average (versus increases of 15 and 13 percent for CABG and pacemaker surgery, respectively.

Surprisingly, thromboendarterectomy charges are lower when the operation is performed by more specialized surgeons. Thoracic and neurosurgeons are paid about $100 less per operation compared with general surgeons. Physicians in multi-specialty groups also receive less than general surgeons but more than the two sub-specialists.

The surgeon's fee is "discounted" substantially when other surgery is performed at the same time: $210 or a 14 percent reduction on the average fee. The surgeon who extra-bills for postoperative visits, furthermore, also lowers his/her fee by $6 for each of those visits. Of course, this $6 reduction per visit is only a fraction of what Medicare has paid the surgeon for the visit. As we found for the other two cardiovascular procedures,

TABLE 3-12

EXPLAINING VARIATION IN CAROTID THROMBOENDARTERECTOMY FEES

	Mean	Coefficient
GPCI	0.980	1,156.77***
Specialty:		
Thoracic Surgeon	0.277	-110.00***
Neurosurgeon	0.087	-90.04***
Multi-Specialty Group	0.046	-28.39**
General Surgeon (omitted group)	0.410	--
Other Surgery at Same Time	0.065	-210.40***
Number of Same Day Visits	0.061	3.01
Number of Preop Visits	0.767	20.78***
Number of Postop Visits	0.372	-6.12***
Assistant Surgeon	0.560	7.90
Surgeons Per Capita	0.537	-287.17***
Beds Per Capita	4.462	-62.95***
Per Capita Income (000's)	13.189	59.41***
Percent Population White	85.280	1.45***
Constant	--	-58.69
R^2	--	0.40
F-ratio	--	422.17***
df	--	8,393

***Significant at one percent level.

Source: Medicare Part B Claims, 1986.

surgeons who bill for preoperative visits actually have higher fees, possibly because carriers have been less able to impose a more global fee definition in high-charge, high-demand areas. Whether or not the surgeon bills for any visits on the same day as the operation, or whether he/she uses an assistant, has no significant effect on the surgical fee.

Competition for patients by surgeons definitely drives down thromboendarterectomy fees. As was found with pacemaker fees, however, the size of the effect is small; a ten percent increase in surgeons per capita only lowers fees by one percent, <u>ceteris paribus</u>. Areas with a greater wealth of hospital beds were hypothesized to have a greater demand for surgery which would drive up surgeons' fees. While this was the case for CABG and pacemaker charges, the opposite is true for thromboendarterectomy fees. The remaining two demand variables, per capita income and percent white, are positive and significant, as expected.

4.0 GEOGRAPHIC VARIATION IN PAYMENTS TO PHYSICIANS FOR THREE ORTHOPEDIC PROCEDURES UNDER MEDICARE

4.1 Introduction

In this chapter, we will examine the extent of geographic variation in Medicare payments to physicians for three common orthopedic procedures and identify key factors associated with that variation. The three procedures are hip fractures, hip replacements, and knee replacements. Descriptive data are shown separately for each in the next three sections, and regression results are presented beginning in Section 4.5. The reader is referred to Chapter 2 for details about how the surgical charge data were cleaned and how the analytic files were constructed.

Two of the three procedures, hip fractures and hip replacements, represent multiple CPT-4 procedure codes. Since Medicare pays different rates for each procedure code, market-area means were calculated using weights based on the distribution of the procedure codes among Medicare patients nationally.

4.2 Hip Fractures

4.2.1 The Surgeon's Fee

The mean allowed fee paid to the surgeon is shown in Table 4-1 for each market area in which at least 50 procedures were performed. Surgeons' fees varied from a high of $1,541 in Middlesex/Somerset, New Jersey to $871 in Enid, Oklahoma. The highest was 1 and 3/4 times as much as the lowest. One of the reasons for the difference may be that it cost more to deliver medical services in some places than in others. When the fees were deflated to account for differences in physician practice costs, the range narrowed somewhat so that the highest (now, Jersey City, New Jersey) was only 1 and 1/2 times as much as the lowest (Richland, Washington). Clearly, much of the variation remains to be explained.

The market areas themselves vary on many characteristics, the most obvious of which is size. In Table 4-2, data are presented for the largest market area in each of the 10 states. Even among the largest areas, considerable variation can be seen in surgeons' fees. The highest, $1,524 in Newark, New Jersey was $459 or 43 percent higher than the lowest, $1,065 in Oklahoma City. When the fees were deflated to account for differences in medical practice costs, the range declined. Surgeons' fees in Atlanta, Georgia were highest at $1,388 and those in Seattle, Washington at $1,070 were lowest; and the difference dropped to $318 or 30 percent. Thus, by concentrating on very large cities, we have narrowed the range, but much of the variation remains to be explained.

TABLE 4-1

MEAN MEDICARE ALLOWED CHARGES FOR HIP FRACTURES BY MARKET AREA[a]

Area	n	Actual	Deflated by GPCI
Alabama			
Anniston	97	$1,101	$1,241
Birmingham	525	1,184	1,245
Dothan	189	1,160	1,434
Florence	87	1,087	1,305
Gadsden	84	1,071	1,162
Huntsville	175	1,098	1,010
Mobile	299	1,219	1,374
Montgomery	181	1,133	1,312
Tuscaloosa	150	1,147	1,198
Rural	504	1,095	1,353
Arizona			
Phoenix	1,037	1,295	1,235
Tucson	457	1,152	1,146
Rural	296	1,183	1,279
Connecticut			
Bridgeport	198	1,245	1,151
Danbury	101	1,341	1,239
Hartford	359	1,177	1,087
Meriden-New Haven	219	1,320	1,368
Middletown	99	1,040	960
New Britain	107	1,170	1,080
New London	104	1,131	1,059
Norwalk	81	1,213	1,121
Stamford	131	1,247	1,153
Waterbury	145	1,145	1,187
Rural	159	1,122	1,169
Georgia			
Albany	104	1,030	1,304
Athens	160	1,074	1,178
Atlanta	1,274	1,287	1,388
Columbia-Richland	211	1,122	1,251
Columbus	135	1,108	1,254
Macon	272	1,094	1,347
Savannah	137	1,121	1,294
Rural	1,129	1,055	1,358
Kansas			
Kansas City	611	1,191	1,265
Lawrence	53	992	982
Topeka	209	1,030	1,156
Wichita	339	1,039	1,047
Rural	934	1,017	1,293

TABLE 4-1 (continued)

MEAN MEDICARE ALLOWED CHARGES FOR HIP FRACTURES BY MARKET AREA[a]

Area	n	Actual	Deflated by GPCI
New Jersey			
Atlantic City	269	1,267	1,367
Jersey City	170	1,476	1,444
Middlesex-Somerset	402	1,541	1,328
Monmouth	482	1,331	1,122
Newark	694	1,524	1,286
Passaic-Bergen	745	1,522	1,516
Philadelphia (PA)	491	1,243	1,167
Trenton	178	1,334	1,213
Vineland-Millville	63	1,218	992
Rural	64	1,503	1,439
Oklahoma			
Comanche	75	974	1,180
Enid	98	871	1,037
Oklahoma City	810	1,065	1,178
Tulsa	488	1,152	1,249
Rural	817	988	1,235
Oregon			
Eugene	155	1,093	1,101
Medford	96	1,153	1,143
Portland	730	1,204	1,192
Salem	178	989	1,120
Rural	570	1,111	1,236
Washington			
Bellingham	102	1,149	1,261
Brementon	84	1,162	1,042
Olympia	90	1,155	1,016
Richland	61	1,078	952
Seattle	1,036	1,197	1,170
Spokane	274	1,068	1,131
Tacoma	325	1,154	1,112
Vancouver	111	1,155	1,159
Yakima	147	1,122	1,300
Rural	546	1,142	1,153

TABLE 4-1 (continued)

MEDICARE NOMINAL AND DEFLATED ALLOWED CHARGES FOR HIP FRACTURES BY AREA[a]

Area	n	Actual	Deflated by GPCI
Wisconsin			
Appleton-Oshkosh	237	1,004	1,138
Green Bay	126	943	982
Kenosha	51	1,100	975
LaCross	74	1,131	1,333
Madison	1,146	1,155	1,213
Milwaukee	649	1,153	1,097
Racine	119	1,102	1,111
Sheboygan	65	1,008	1,107
Rural	628	1,081	1,275
All Areas	23,651	1,156	1,194
Ratio of Highest to Lowest Charge Areas		1.77	1.59

[a]Weighted means have been calculated across two hip fracture codes using national frequencies as weights.

Source: Medicare Part B Claims, 10 States, 1986.

The surgeons' fee is intended to cover not only the operation itself, but also other services related to the surgery, including some visits with the patient both in the hospital and in the doctor's office. On the other hand, some variation in treatment may be expected because patients' conditions differ and because physicians have different practice styles. There still is a certain amount of "art" to medical practice. For these reasons, in Table 4-2, we also present data on certain elements of the service provided to patients with hip fractures.

4.2.2 Variation in Services in 10 Large Markets

Since one of the reasons for differences in fees for hip fracture surgery may be that the payments were buying different bundles of services -- even though, as global fees, the surgeon's payment includes more than the surgery itself. In Table 4-2 data are presented on certain services associated with hip fracture surgery for which separate payments were made. Thus, in each market area, some patients had other orthopedic procedures on the same day as their hip fracture surgery. In four of those large markets (Kansas City, Birmingham, Hartford, and Newark), 6 to 7 percent of hip fracture patients had additional orthopedic surgeries, while in three others (Portland, Oklahoma City, and Phoenix), the proportion was under 2 percent. The remaining three cities fell between these extremes.

The likelihood of additional non-orthopedic surgery was still smaller, with six of the ten cities at less than 2 percent. In Hartford and Seattle, at the high end of the scale, only 4.8 and 4.5 percent of hip fracture patients received non-orthopedic surgeries on the same day as the primary surgery.

A surgeon performing a second procedure would receive an additional fee, and even though the payment would be only 50 percent of the allowed charge for the procedure, it is possible that a surgeon would attempt to compensate for what he considered to be a low fee for the surgery by billing for additional procedures. This is possible even though the numbers in Table 4-2 for additional surgeries are small, and the market-level means are relatively unaffected. We will explore this possibility in the multivariate analysis reported in Section 4.2.4.

Another aspect of the surgery was the likelihood that the surgeon would have an assistant. Typically, the assistant was paid 20 percent of the fee of the primary surgeon. One possibility is that, if surgeons believed they were underpaid by Medicare, they might arrange to reduce their work to a level they considered to be commensurate with the fee by having another orthopedist act as an assistant. In fact, it is possible that, in such an environment, orthopedists might arrange to assist one another in partial compensation for what they considered to be low payments. Another hypothesis is that, since practice styles have been observed to vary, geographic differences might simply reflect the variety in nearby training programs.

TABLE 4-2

SURGEONS' FEES AND SERVICE PATTERNS FOR HIP FRACTURES FOR 10 LARGE CITIES[a]

	Birmingham AL	Phoenix AZ	Hartford CT	Atlanta GA	Kansas City KA	Newark NJ	Oklahoma City OK	Portland OR	Seattle WA	Milwaukee WI
Surgeon's Fee	$1,184	$1,295	$1,177	$1,287	$1,191	$1,524	$1,065	$1,204	$1,197	$1,153
Deflated Surgeon's Fee	1,245	1,235	1,087	1,388	1,265	1,286	1,178	1,192	1,070	1,097
Same Day Services										
% W/Other Orthopedic Surgery	7.0	1.8	7.0	5.2	6.2	7.1	1.4	.4	4.0	4.3
% W/Non-Ortho. Surgery	1.5	1.0	4.8	.7	3.4	2.7	1.6	.8	4.5	1.6
% W/Assistant Surgeon	13.0	29.5	5.0	6.6	8.7	36.5	5.2	34.1	41.2	19.3
# Visits by Surgeon	.09	.37	.05	.31	.02	.15	.11	.28	.02	.02
# Visits by Other M.D.	.53	.53	.54	.63	.57	.63	.59	.45	.48	.52
Pre-Operative Services										
# Visits by Surgeon	.51	.51	.31	.65	.07	1.00	.40	.29	.11	.06
# Visits by Other M.D.	2.81	1.94	2.67	2.28	3.68	3.69	2.30	1.42	1.61	1.62
Post-Operative Services Inpatient										
# Visits by Surgeon	.70	.17	.20	.12	.21	.60	.07	.03	.49	.37
# Visits by Other M.D.	10.04	8.52	8.24	10.41	10.23	11.95	10.36	6.50	6.50	9.91
Out-of-Hospital										
# Visits by Surgeon	.26	.09	.50	.07	.16	.17	.05	.05	.07	.35
# Visits by Other M.D.	1.03	1.29	.83	1.28	1.67	1.35	.84	.87	1.88	1.51

[a] Weighted means have been calculated across two hip fracture codes using national frequencies as weights.

Source: Medicare Part B Claims, 10 States, 1986.

Without being able to assign an explanation to the findings in Table 4-2, it can be seen that the ten large markets vary dramatically in the likelihood that the hip fracture surgeon would be assisted by another surgeon. Thus, at the low end, from 5 to 9 percent of patients in four cities (Hartford, Atlanta, Kansas City, and Oklahoma City) had an assistant surgeon; while in four other cities (Phoenix, Newark, Portland, and Seattle), 30 percent or more of patients were operated on by two surgeons. Part of the difference may reflect the relative availability of surgical residents in the hospitals where the surgery was performed since residents are considered to be part of the hospital's costs and are reflected in Part A payments under Medicare. Regardless, these differences are so large that, whatever the explanation, it is unlikely to be that the nature of the patients' conditions in the latter cities required an extra pair of hands.

Although the surgeon's fee is intended to include pre- and post-operative visits, the number and proximity to the surgery itself are not specified uniformly in all geographic areas. It may be, therefore, that the variety of surgical fees reflects market-area differences regarding the inclusion of visits with the patients. In general, surgeons billed for very few visits on the same day as the surgery although the variation from lowest to highest was almost 20-fold. The same pattern held for pre-operative and post-operative visits by the surgeon, as well: a relatively small number of visits per person, but substantial variation from market to market.

Finally, the extent to which other physicians were involved is reflected in the visits by other physicians before and after the surgery, as well as on the day of the surgery itself. In all ten of the largest markets, physicians who were not the surgeon billed for an average of more than one visit in each case. The range was from 1.42 visits in Portland to 3.68 and 3.69 in Kansas City and Newark, respectively. Further, following the surgery, physicians who were not the surgeon visited patients in the hospital and billed for at least 6.5 visits (in Portland and Seattle) and for as many as 12 visits in Newark. Since these are elderly patients and the period included 90 days after the surgery, some of the visits may be for conditions unrelated to the hip fracture.

4.2.3 Implications for Expenditures

We have observed substantial variation in the extent to which various services are provided. What are the implications in dollars? To begin to address this question, we examined the experience in five urban market areas, with one from each of the five quintiles of surgeon's fees. (See Table 4-3.) Thus, we see that the average fee received by Newark surgeons for hip fracture surgery was $1,524, while their counterparts in the Appleton/Oshkosh area of Eastern Wisconsin earned $1,004, a ratio of just over 1.5 to 1.

TABLE 4-3

ADJUSTMENTS TO HIP FRACTURE FEES FOR ADDITIONAL BILLINGS AND ADDITIONAL SERVICES[a]

	Newark NJ	Portland OR	Montgomery AL	Oklahoma City OK	Appleton/ Oshkosh WI	Ratio of Highest Area to Lowest Area
Surgeon's Fee	$1,524	$1,204	$1,133	$1,065	$1,004	1.52
Surgeon's Fee (deflated)	$1,286	$1,192	$1,311	$1,178	$1,138	1.15
Including Visits by the Surgeon (before, on day of, or after surgery)	$1,361	$1,221	$1,385	$1,208	$1,148	1.21
Including Other Orthopedic Surgery	$1,399	$1,222	$1,411	$1,213	$1,158	1.22
Including Other Surgery on the Same Day	$1,401	$1,223	$1,414	$1,218	$1,159	1.22
Including Assistant Surgeons	$1,412	$1,298	$1,448	$1,229	$1,300	1.18
Including Other Post-Surgical Services (not visits) by Surgeon	$1,459	$1,350	$1,500	$1,268	$1,354	1.18
Amount Added to Surgeon's (deflated) Fee	$173	$158	$189	$90	$216	

[a]Weighted means have been caluclated across two hip fracture codes using national frequencies as weights.

Source: Medicare Part B Claims, 10 States, 1986.

When those nominal dollars were deflated to control for differences in practice costs, Montgomery, Alabama surgeons received the highest fees, $1,311 or $25 more than Newark surgeons. Appleton/Oshkosh surgeons still had the smallest fees, but they increased to $1,138; and the highest was only 1.15 times the lowest.

Payments for visits by the surgeons added to the cost an average of from $10 in Appleton/Oshkosh to $74 and $75 in Montgomery and Newark, respectively. Payments for other orthopedic procedures added an average of only $1 and $5 in Portland and Oklahoma City, respectively; but $38 in Newark.

The use of assistant surgeons added $141 to the cost of surgery in Appleton/Oshkosh, almost twice as much as in the next highest city, Portland. And, finally, post-surgical services provided by the surgeon added an average of from $39 to $54 to the bill, a relatively small difference.

Altogether, payments to the surgeons increased by an average of $90 in Oklahoma City to $216 in Appleton/Oshkosh by the addition of these charges. The largest reduction in variation was attributed to differences in physician practice costs; and the other services not only added to the cost of the procedure but increased somewhat the variation from the lowest to the highest market.

4.2.4 Explaining Variations in Hip Fracture Fees

In Tables 4-2 and 4-3, data were presented which described some of the patterns of service for selected market areas and, then, demonstrated the contribution that each of several important characteristics made to the cost of hip fracture surgery in five markets. While those results demonstrated clearly that the markets differed in substantial ways, they did not help us to understand the results. In an effort to explain the geographic variation in surgeons'fees for hip fractures, we performed multivariate regressions which permitted us to consider simultaneously the effects of a variety of relevant factors on the geographic variation in surgeons' allowed charges. This analysis includes all hip fracture procedures performed in the 76 market areas with at least 50 such operations in 1986, but the individual operation, not the market area, is the unit of analysis.

The equation included four groups of independent variables:

1. The Geographic Practice Cost Index;

2. Factors associated with the surgery: these included dummy variables for the presence of bills for additional operations and for assistant surgeons; and the number of bills submitted by the surgeon for visits and/or other services on the day of the surgery, prior to it, or following it in the period before the patient was released from the hospital.

3. Market Area Characteristics: these included surgeons per 1,000 population; hospital beds per 1,000 population; per capita income; and the percent of the population who were white.

Table 4.4 presents the regression results, along with the means for the independent variables. The surgeons' allowed charges are highly affected by the GPCI; the coefficient is large, positive, and statistically significant at less than the .001 level. Moreover, when it was entered in a regression equation which included only dummy variables for the specific procedure codes, the GPCI by itself explained 31.6 percent of the variance in surgeons' allowed charges. These results mean that as practice costs increase, fees also tend to increase. That is as expected because Medicare attempts to include the cost of performing the procedure in the fees it pays surgeons.

When other surgery was performed at the same time as the hip fracture, the surgeon's fee tended to be lower, but only by about $10. It might be argued that the additional surgery was performed in part to compensate for what the surgeon considered to be a low fee, but since the difference was only $10, that is not a very powerful argument. Moreover, since such a small amount was added to the fee (less than 1 percent), it is not a very important element from a policy viewpoint, either.

We might have expected that bills for assistant surgeons might also be explained in part as an effort to compensate for perceived low fees. This might be the case for two reasons: first, by using an assistant, a surgeon might be able to spend less time on the procedure, thus, increasing the income relative to the work involved and freeing himself or herself to perform other income-producing surgery. Secondly, if several surgeons in an area work together to assist one another, then on some procedures one might be the primary surgeon and receive the Medicare-allowed charge while another might be the assistant and receive the 20 percent assistant's fee. On others, they might reverse the primary and assistant roles. If this were done systematically, then the cost of surgeons' services to Medicare would increase by 20 percent. The regression results show, however, that the submission of bills by assistant surgeons was not statistically significant for hip fracture surgery.

Earlier, we saw that the likelihood was quite small that the surgeon would bill for visits on the day of the surgery, before it, or after it. The regression results show that the contribution of the number of same-day and pre-operative visits by the surgeon was positive and statistically significant, but the size of the coefficient was small. Nonetheless, the results mean that there were likely to be more visits in areas where the fee was higher than where it was lower. The same was true with other services performed by the surgeon prior to or on the same day as the surgery; that is, the effect was small, but positive and statistically significant. Visits and other services provided by the surgeon following the surgery, on the other hand, were not statistically significant.

Looking at market-level factors, all four variables produced small, but statistically significant coefficients. In markets with more surgeons for the population, the coefficient was negative, meaning that the allowed charges

TABLE 4-4

EXPLAINING VARIATION IN HIP FRACTURE FEES

	Mean	Coefficient
GPCI	0.965	906.45***
Other Surgery at the Same Time	0.062	-9.96***
Assistant Surgeon	0.231	-1.74
Number of Same Day Visits	0.097	28.22***
Number of Preoperative Visits	0.457	9.73***
Number of Postoperative Visits	0.348	.24
Number of Other Same Day Services	1.133	.22**
Number of Presurgery Services	7.879	.03***
Number of Postsurgery Services	6.752	.01
Surgeons per Capita	0.367	-32.59***
Beds per Capita	4.469	-8.41***
Per Capita Income (000)	13.107	0.02***
Percent Population White	86.153	-0.05***
Constant	---	508.13***
R^2	---	0.45
F-ratio	---	1241.25
df	---	25313

***Significant at one percent level.

**Significant at five percent level.

Source: Medicare Part B Claims, 10 States, 1986.

were lower in areas with higher surgeon-to-population ratios. These results are consistent with classical economic theory which suggests that, assuming a relatively finite demand for a product or service, its producers will compete partly by lowering their prices in the hopes of attracting a larger share of the market from price-sensitive consumers. On the other hand, since surgery is usually well covered by insurance and the demand is determined to a large degree by the patient's medical condition (he or she either has a hip fracture or not), this classical explanation may not be a useful one even though it is consistent with the results.

Hospital beds per thousand population also produced a statistically signficant but small coefficient. Again, hospitals have an interest in filling their beds and, in a highly competitive market, they may have lowered prices as part of a strategy to do so; but since neither the physician nor the patient, who collaborate on the decision to hospitalize, face the cost of the hospital's services, that explanation for the results is not persuasive.

Per capita income has a small, positive association with the surgeon's allowed charge, perhaps reflecting the fact that people with higher incomes were likely to be insured, and since historically insurers paid physicians' charges, surgeons were assured of being paid even if their fees were relatively high. On the other hand, the proportion of the population who were white had a negative coefficient. If we assume this variable is a proxy for a number of factors associated with increased demand for services (e.g., employment, higher education, greater likelihood of insurance and better coverage, among others), then, we would expect it to have acted in the same way as the income variable. The fact that it did not is puzzling.

4.3 Total Hip Replacements

4.3.1 The Surgeon's Fee

Hip replacements tend to be attempted as a drastic solution to difficult and long-standing hip problems and, thus, are planned further in advance than surgery to repair a hip fracture. Generally, they are more complicated surgeries to perform, as well. Table 4-5 presents the weighted average surgeon's fees for those market areas in the ten states in which at least 50 hip replacements were performed in 1986. The highest, $2,586, was found in the New Haven-Meriden market in Connecticut, while the lowest for an urban area was $1,724 in Milwaukee, Wisconsin. These fees were 150-200 percent of those for hip fractures, reflecting the greater complexity of the procedures, among other factors.

When the mean surgical payment was deflated to take account of differences in the cost of practicing medicine, the market with the highest average fees was Dothan Alabama ($2,985), and the market with the lowest, was still Milwaukee at $1,640.

TABLE 4-5

MEAN MEDICARE ALLOWED CHARGES FOR HIP REPLACEMENTS BY MARKET AREA[a]

Area	n	Actual	Deflated by GPCI
Alabama			
Birmingham	465	2,508	2,637
Dotham	50	2,415	2,985
Florence	94	2,357	2,829
Huntsville	95	2,210	2,033
Mobile	151	2,217	2,499
Montgomery	88	2,412	2,792
Rural	161	2,379	2,941
Arizona			
Phoenix	816	2,491	2,375
Tucson	266	2,406	2,394
Rural	65	2,468	2,668
Connecticut			
Hartford	303	2,417	2,232
Meriden-New Haven	93	2,586	2,679
New Britain	50	2,394	2,211
Waterbury	117	2,383	2,469
Rural	55	2,247	2,341
Georgia			
Athens	60	2,417	2,650
Atlanta	589	2,331	2,515
Columbia-Richland	73	2,498	2,785
Columbus	105	2,279	2,578
Macon	65	2,093	2,578
Savannah	87	2,053	2,370
Rural	221	2,257	2,904
Kansas			
Kansas City	549	2,092	2,221
St. Joseph (MO)	65	2,137	2,584
New Jersey			
Atlantic City	95	2,412	2,601
Middlesex-Somerset	219	2,402	2,071
Monmouth	237	1,974	1,664
Newark	572	2,378	2,007
Passaic-Bergen	318	2,345	2,028
Philadelphia (PA)	171	2,184	2,050
Trenton	60	2,033	1,848

TABLE 4-5 (continued)

MEAN MEDICARE ALLOWED CHARGES FOR HIP REPLACEMENTS BY MARKET AREA[a]

Area	n	Actual	Deflated by GPCI
Oklahoma			
Oklahoma City	337	1,915	2,118
Tulsa	154	1,889	2,049
Rural	181	1,623	2,029
Oregon			
Eugene	99	2,213	2,228
Medford	102	1,999	1,981
Portland	390	2,215	2,193
Salem	92	2,172	2,460
Rural	291	2,157	2,399
Washington			
Olympia	53	2,166	1,905
Seattle	714	2,225	1,990
Spokane	224	2,375	2,516
Tacoma	184	2,131	2,053
Vancouver	52	1,745	1,752
Yakima	88	2,059	2,386
Rural	259	2,215	2,238
Wisconsin			
Appleton-Oshkosh	181	1,857	2,105
Green Bay	156	2,060	2,143
Madison	711	2,197	2,308
Milwaukee	501	1,724	1,640
Rural	243	1,960	2,312
All Areas	11,367	2,199	2,317
Ratio of Highest to Lowest Charge Areas		1.59	1.82

[a]Weighted means have been calculated across three hip replacement codes using national frequencies as weights.

Source: Medicare Part B Claims, 10 States, 1986.

4.3.2 Variations in Services in 10 Large Markets

Looking at only the largest markets in each of the 10 study states, we see that the highest average surgical fee was in Birmingham, Alabama ($2,508) and the lowest, in Milwaukee, Wisconsin ($1,724). (See Table 4-6.) When they were deflated to take account of practice costs, the same two cities were at the extremes, but the gap had widened. The average fee in Birmingham, because practice costs tended to be less expensive than many other areas, increased to $2,637, while that in Milwaukee, which was more costly, dropped to $1,640.

The proportion of patients with additional orthopedic surgeries on the same day as their hip replacements varied from only 1 percent in Oklahoma City to 10.3 percent in Kansas City, Kansas, a 10-fold difference. The others were scattered in between. On the other hand, except for three markets, the likelihood of other non-orthopedic surgery on that day was very small (2.1 percent or less). The three exceptions were Kansas City and Seattle, at 10 percent, and Hartford, at 6.5 percent.

In more than half the cases in three markets (Newark, Seattle, and Portland), the principal surgeon was assisted by another physician, who usually was paid 20 percent of the amount paid to the surgeon. In the remaining seven large markets, the range was roughly 20 percent to 40 percent. While the amount of variation was wide, the likelihood of the surgeon having an assistant tended to be much greater everywhere for hip replacements than for hip fractures. Part of the explanation undoubtedly reflects the greater complexity of these procedures. On the other hand, the large range is as hard to explain as it was for hip fractures. It is hard to imagine that the presence of complex cases is so variable that it explained the range. As with hip fractures, practice styles and attempts by surgeons to compensate for low fees may have contributed to the explanation. Another possibility may be related to the process of diffusion of new technology.

Typically, new surgical procedures, like hip replacements, begin experimentally in large medical centers affiliated with medical schools and, after the original surgeon has perfected the procedure to his satisfaction, he begins to share it by presenting it to colleagues at his own or neighboring hospitals, describing it in medical meetings, and publishing it in professional journals. Gradually, others begin to perform the operation, too, and it enters the surgeons' armamentarium. A part of the process of diffusion is the practice of surgeons' assisting more experienced colleagues in performing the procedure. In other words, they learn by doing, and eventually begin performing the procedure on their own patients in their regular hospital. Part of the explanation for the greater presence of assistants may be the diffusion of a relatively new procedure, and the variation may be explained in part by the likelihood that the procedure was introduced into different markets at different times. Nonetheless, a large amount remains unexplained.

TABLE 4-6

SURGEONS' FEES AND SERVICE PATTERNS FOR HIP REPLACEMENTS FOR 10 LARGE CITIES[a]

	Birmingham AL	Phoenix AZ	Hartford CT	Atlanta GA	Kansas City KA	Newark NJ	Oklahoma City OK	Portland OR	Seattle WA	Milwaukee WI
Surgeon's Fee	$2,508	$2,491	$2,417	$2,331	$2,092	$2,378	$1,915	$2,215	$2,225	$1,724
Deflated Surgeon's Fee	2,637	2,375	2,232	2,515	2,221	2,007	2,118	2,193	1,990	1,640
Same Day Services										
% W/Other Orthopedic Surgery	7.4	2.0	7.1	5.6	10.3	4.1	1.0	2.1	6.0	4.6
% W/Non-Ortho. Surgery	0.5	1.8	6.5	1.4	10.0	2.1	0.5	0.7	10.0	0.3
% W/Assistant Surgeon	39.1	43.4	21.5	30.4	39.8	55.1	28.5	74.8	63.7	27.6
# Visits by Surgeon	.05	.18	.04	.20	.02	.10	.05	.05	.02	.01
# Visits by Other M.D.	.48	.41	.39	.44	.49	.56	.37	.20	.23	.30
Pre-Operative Services										
# Visits by Surgeon	.48	.60	.25	.65	.12	.68	.47	.38	.27	.11
# Visits by Other M.D.	2.48	1.94	1.86	1.94	1.83	3.00	2.28	.95	1.16	1.25
Post-Operative Services Inpatient										
# Visits by Surgeon	.19	.19	.35	.11	.16	.61	.13	.01	.59	.09
# Visits by Other M.D.	13.78	6.80	6.97	7.09	7.99	10.05	8.83	5.40	4.82	6.40
Out-of-Hospital										
# Visits by Surgeon	.05	.08	.90	.12	.16	.21	.08	.08	.20	.38
# Visits by Other M.D.	1.06	1.09	.93	1.26	1.09	1.26	.76	1.02	1.16	1.03

[a] Weighted means have been calculated across three hip replacement codes using national frequencies as weights.

Source: Medicare Part B Claims, 10 States, 1986.

The probability that a surgeon would have billed for visits, whether before or after the surgery was small in all markets. Even so, however, there was a 6-fold difference between Milwaukee, where surgeons billed for an average of .11 preoperative visits, and Atlanta, whose surgeons billed for .65 visits. The range for post-operative in-hospital visits was similar. Thus, in general, surgeons did not use extra visits with patients as a means of compensating for low fees. A much greater number of visits by other physicians was observed, although some may have been unrelated to the hip replacement.

4.3.3 The Impact of Extra Billing on Fees

In Table 4-7 data are presented which demonstrate the contribution of these other services to expenditures for services rendered to patients with hip replacements. As with hip fractures, five market areas were chosen, one from each of the quintiles of average actual surgeon fees.

Since all five of the cities are the largest in their respective states, we have already seen the weighted average surgeons' fees. Birmingham and Milwaukee were at the upper and lower ends, respectively, and the distance between them widened when the average fees were deflated to account for practice cost differences. It will be noted that this finding contrasts with the similar one for hip fractures.

Separate bills for visits added from $13 (Kansas City) to $56 (Newark) to the expenditures, and the gap between the highest and lowest increased slightly. Similarly, other orthopedic surgeries performed on the same day as the hip replacement added from $15 (Milwaukee) to $75 (Kansas City). Non-orthopedic surgeries performed on that day added $6 or less in four of the five cities; and $13 in Kansas City.

The presence of assistant surgeons added $102 to the payments for hip replacements in Milwaukee, but more than twice that amount in three other cities (Seattle, Newark, and Birmingham). Finally, other services (i.e., not visits) provided by the surgeon added from $91 (Milwaukee) to $120 (Kansas City), a relatively small range.

In sum, all of these services for which additional payments were made added from $209 (Milwaukee) to $428 (Birmingham) to the expenditures for hip replacements. It is worth noting that the city with the smallest add-on was the one with the lowest weighted average surgeon's fee, and that with the largest addition had the highest fee. Clearly, the increments do not represent compensation for low initial fees.

TABLE 4-7

ADJUSTMENTS TO SURGEON'S HIP REPLACEMENT FEES

	Birming-ham	Newark	Seattle	Kansas City	Milwaukee	Ratio of Highest to Lowest
Surgeon's Fee	$2,508	$2,378	$2,225	$2,092	$1,724	1.45
Surgeon's Fee (deflated)	2,637	2,007	1,990	2,221	1,640	1.61
Visits by the Surgeon (before, on day of, or after surgery)	2,677	2,063	2,014	2,234	1,655	1.62
Other Orthopedic Surgery	2,734	2,095	2,038	2,309	1,670	1.64
Other Surgery on the Same Day	2,735	2,100	2,044	2,322	1,671	1.64
Assistant Surgeons	2,951	2,324	2,305	2,495	1,773	1.66
Other Post-Surgical Services (not visits) by Surgeon	3,065	2,425	2,409	2,615	2,864	1.64
Amount Added to Surgeon's (deflated) Fee	$428	418	419	394	209	

[a]Weighted means have been calculated across three hip replacement codes using national frequencies as weights.

Source: Medicare Part B Claims, 10 States, 1986.

4.3.4 Explaining Variations in Surgeons' Fees for Hip Replacements

The regression used to explain the variation in surgeons' fees for hip replacements (See Table 4-8) was basically similar to that used in the case of hip fractures although some of the results were different.

The GPCI was positively related to the surgeons' allowed charges and highly significant. Thus, other things being equal, an increase in physician practice costs resulted in an increase in allowed charges although it had a smaller impact with hip replacement fees than with fees for hip fractures.

Looking at the surgical procedure itself, the relationship between the allowed charge and the submission of bills for work performed by an assistant surgeon was not statistically significant. That finding is consistent with the result for hip fracture surgery, too. When we looked at the performance of additional surgeries on the same day as the hip fracture, we found that the surgeon's fee was $10 lower. For hip replacements, however, there was no statistically signficant relationship with the surgeon's fee. Thus, it would be erroneous to argue that the hip replacement surgeon compensated for what he considered to be low Medicare fees either by providing additional surgery or by reducing his own work by bringing in an assistant to perform part of the procedure.

On the other hand, the numbers of preoperative and same-day visits billed by the surgeon were directly related to the fee and highly significant. The mean approached one-half of a visit per patient prior to the surgery and was very small for the same day as the surgery. Nonetheless, these results, which are consistent with those presented earlier regarding hip fracture surgery, indicate that, when the fee was higher, the number of prior and same-day visits also tended to be higher. The number of post-operative visits, on the other hand, while still small, was negatively related to the surgeon's allowed charge. Since the compensation theory is not supported by the prior and same-day visits, it probably does not explain the post-surgery visits either even though the results are consistent with that interpretation.

At the market level, the number of surgeons per capita was positively related to the surgeon's fee, meaning that fees were higher in markets with more surgeons. This finding is contrary both to that observed in connection with hip fracture procedures and to the theory that suggests that fees should be lower in markets with a higher ratio of providers of a service to the potential consumers of that service.

Per capita income and the proportion of the population who were white showed statistically significant negative relationships with the surgeon's allowed charge, but both were small. These results are puzzling since it would be expected that both of these factors would be related to higher demand and a greater ability to pay for the surgery, both of which could support higher surgeons' fees. Yet, the results indicate that fees were somewhat

TABLE 4-8

EXPLAINING VARIATION IN HIP REPLACEMENT FEES

	Mean	Coefficient
GPCI	.989	452.26***
Other Surgery at the Same Time	.080	-14.58
Assistant Surgeon	.492	1.17
Number of Same Day Visits	.057	97.92***
Number of Preoperative Visits	.437	15.20***
Number of Postoperative Visits	.285	-7.20***
Number of Other Same Day Services	.483	1.29*
Number of Other Presurgery Services	12.983	-0.01
Number of Other Postsurgery Services	11.593	-0.004
Surgeons per Capita	.402	145.27***
Beds per Capita	4.414	-5.30*
Per Capita Income (000)	13.016	-0.02***
Percent Population White	85.955	-0.04***
Constant	---	2282.11***
R^2	---	.10
F-ratio	---	72.19
df	---	11502

***Significant at one percent level.
**Significant at five percent level.
*Significant at ten percent level.

Source: Medicare Part B Claims, 10 States, 1986.

lower in areas in which per capita income and the proportion of the population who were white were higher after the other market-level factors were controlled.

The combination of these factors explained only 10 percent of the variance in surgeon's fees paid by Medicare. When dummy variables were used for the market areas in a separate regression that included no other factors, 29 percent of the variance was explained. Clearly, market as a concept is strongly related to the geographic variation in surgeons' fees for hip replacements, but the specific variables used in the regression equations, whether at the market level or at the level of the operation itself, captured only a relatively small amount of the variance in fees. This is in marked contrast to the regression results shown earlier for hip fractures and for cardiovascular procedures (Chapter 3).

4.4 Total Knee Replacements

4.4.1 The Surgeon's Fee

Of the three orthopedic procedures being considered, knee replacements are both the newest and the most complex. In the markets with at least 50 operations in 1986, the highest weighted mean surgeon's fee was $2,615 in Passaic/Bergen, New Jersey. (See Table 4-9.) The lowest was $1,561 in Enid, Oklahoma. The difference between them was $1,054 or 68 percent. When the fees were deflated to account for the varying cost of practice in these markets, the highest fee became $3,114 in Dothan, Alabama; and the lowest, $1,685 in Milwaukee, Wisconsin. The range from lowest to highest increased by almost $400 and 17 percent when physician practice costs were taken into account.

As with the other orthopedic procedures we examined, the variation might be accounted for in a number of reasonable ways. If the fees covered different bundles of services, higher fees might pay for additional care. If the distribution of severe cases were skewed toward large urban medical centers with more sophisticated equipment and more experienced surgical teams, higher prices in those areas might reflect the variation in severity. To begin to examine those possibilities, we looked at a series of variables related to the surgery for the largest markets in each of the ten states. (See Table 4-10.)

4.4.2 Variations in Services in 10 Large Markets

Among the ten largest markets, the highest weighted mean surgeon's fee was $2,568 in Newark, New Jersey. The lowest was $1,770 in Milwaukee, Wisconsin. When physician practice costs were factored in, the range was from $2,631 in Birmingham, Alabama, and the lowest was still in Milwaukee, $1,685.

TABLE 4-9

MEAN MEDICARE ALLOWED CHARGES FOR KNEE REPLACEMENTS BY MARKET AREA

Area	n	Actual	Deflated by GPCI
Alabama			
Birmingham	257	2,502	2,631
Dothan	62	2,519	3,114
Mobile	89	2,102	2,370
Rural	105	2,462	3,043
Arizona			
Phoenix	736	2,378	2,267
Tucson	217	2,061	2,050
Rural	107	2,241	2,423
Connecticut			
Hartford	132	2,190	2,022
Waterbury	56	2,201	2,281
Georgia			
Athens	54	1,855	2,034
Atlanta	302	2,174	2,346
Columbus	163	2,299	2,600
Savannah	57	2,187	2,525
Rural	206	2,087	2,686
Kansas			
Kansas City	467	2,263	2,402
Topeka	147	2,285	2,564
Wichita	221	2,303	2,319
Rural	329	2,259	2,870
New Jersey			
Middlesex-Somerset	121	2,579	2,223
Monmouth	84	2,163	1,824
Newark	180	2,568	2,167
Passaic-Bergen	181	2,615	2,262
Philadelphia (PA)	154	2,260	2,122
Oklahoma			
Enid	54	1,561	1,859
Oklahoma City	390	1,687	1,866
Tulsa	116	2,233	2,422
Rural	178	1,624	2,031

TABLE 4-9 (continued)

MEAN MEDICARE ALLOWED CHARGES FOR KNEE REPLACEMENTS BY MARKET AREA

Area	n	Actual	Deflated by GPCI
Oregon			
Eugene	57	2,008	2,022
Medford	67	2,010	1,992
Portland	216	2,077	2,057
Salem	54	1,971	2,233
Rural	223	2,054	2,285
Washington			
Seattle	340	2,312	2,068
Spokane	169	2,465	2,611
Tacoma	113	2,230	2,148
Yakima	67	2,036	2,359
Rural	222	2,348	2,372
Wisconsin			
Appleton-Oshkosh	186	1,957	2,219
Green Bay	157	1,989	2,070
Madison	547	1,948	2,047
Milwaukee	187	1,770	1,685
Rural	155	1,881	2,218
All Areas	7,925	2,160	2,279
Ratio of Highest to Lowest Charge Area		1.68	1.85

Source: Medicare Part B Claims, 10 States, 1986.

TABLE 4-10

KNEE REPLACEMENTS SELECTED VARIABLES FOR 10 MARKET AREAS

	Birmingham AL	Phoenix AZ	Hartford CT	Atlanta GA	Kansas City KA	Newark NJ	Oklahoma City OK	Portland OR	Seattle WA	Milwaukee WI
Surgeon's Fee	$2,502	$2,378	$2,190	$2,174	$2,263	$2,568	$1,687	$2,077	$2,312	$1,770
Deflated Surgeon's Fee	$2,631	$2,267	$2,022	$2,346	$2,402	$2,167	$1,866	$2,057	$2,068	$1,685
Same Day Services										
% W/Other Orthopedic Surgery	8.6	1.6	3.0	7.0	9.4	6.7	0.8	0.0	3.2	3.7
% W/Non-Ortho. Surgery	0.4	1.2	0.0	0.7	4.9	4.4	0.0	0.5	2.1	0.5
% W/Assistant Surgeon	41.2	41.4	17.4	41.7	44.5	66.7	19.7	74.5	64.7	36.4
# Visits by Surgeon	0.0	.15	.02	.20	.01	.08	.06	.01	.03	.01
# Visits by Other M.D.	.38	.35	.30	.60	.60	.41	.43	.13	.17	.26
Pre-Operative Services										
# Visits by Surgeon	.43	.52	.31	.66	.16	.32	.30	.31	.15	.09
# Visits by Other M.D.	1.55	1.31	1.67	1.55	1.75	1.40	.83	.72	.53	.81
Post-Operative Services Inpatient										
# Visits by Surgeon	.21	.13	.23	.26	.31	.60	.15	.08	.34	.12
# Visits by Other M.D.	11.07	5.16	5.14	7.12	7.44	7.84	4.46	4.30	4.05	4.29
Out-of-Hospital										
# Visits by Surgeon	.08	.37	1.06	.56	.81	.92	.07	.15	.32	1.16
# Visits by Other M.D.	1.12	.128	.88	1.13	1.08	2.38	.88	1.00	1.26	.78

Source: Medicare Part B Claims, 10 States, 1986.

Although the range increased by about $150, it was $250 less than the range when all markets were considered. Thus, some of the variation disappeared when the size of the city was controlled (i.e., when only large cities were examined).

The likelihood of other orthopedic surgery on the day of the knee replacements ranged from 0 in Portland, Oregon and less than 1 percent in Oklahoma City to 9.4 percent and 8.6 percent in Kansas City and Birmingham, respectively. Very little non-orthopedic surgery was performed on the same day as the knee replacement. In fact, in only Kansas City (4.9 percent) and Newark (4.4 percent) did more than 2 percent of knee replacement patients have non-orthopedic surgery, as well.

On the other hand, although the likelihood of the surgeon's having an assistant who submitted a separate bill was substantial in all cities, the difference between the highest and lowest was almost 60 percent. Thus, surgeons in 17 percent of knee replacement operations in Hartford and 20 percent in Oklahoma City had assistants while 75 percent of those in Portland, 67 percent in Newark, and 65 percent in Seattle used assistant surgeons.

As observed with the other two orthopedic procedures, knee replacement surgeons billed for very few additional visits with the patient before or after the surgery, although, here, too, the proportional differences were large. Combining all types of visits, surgeons in Portland and Oklahoma City, billed for an average of .55 and .58 visits per patient, respectively. At the other end of the scale, surgeons in Newark billed for 1.92 visits per person on average, more than three times the number of Portland and Oklahoma City.

Visits by physicians other than the surgeon were more common although it is difficult to be sure how many were associated with the surgery and how many, related to other conditions. We can be relatively certain that those that occurred on the day of the surgery or during the week before it were related to the surgery. In Portland and Seattle, other physicians billed for fewer than one visit per person on average (.85 and .70, respectively). On the other hand, physicians in Kansas City (2.35 visits) and Atlanta (2.15 visits) billed for an average of more than two visits per person. After the surgery, in-hospital visits by other physicians ranged from an average of 11 visits in Birmingham to only four visits in Seattle. Moreover, since it appears that the vast majority in all 10 markets occurred during the first 14 days following the operation, it can be assumed that they were related to the knee replacement surgery. To what extent did these differences affect payments for knee replacement surgery? We turn to that question in the next section.

4.4.3 Implications of Extra-Billing for Fees

Looking at five market areas, one from each of the quintiles of surgeons' fees, we compared Newark, Seattle, Tulsa, Portland, and Milwaukee in descending order by surgeon's weighted average fee. (See Table 4-11.) Thus, Newark had a fee of $2,567, while the fee in Milwaukee was only $1,770, a difference of almost $800. When the fees were deflated to account for differences in physician practice costs, Tulsa became the city with the highest fee, $2,422, while Milwaukee remained the one with the lowest, $1,684. The difference between the highest and lowest deflated fees was $738, only about $40 less than the difference in average nominal fees. Indeed, the ratio of highest to lowest nominal fee was 1.45, while that for deflated fees dropped only .01.

Additional charges by the surgeons for visits with patients (before or after the surgery) added $15 to the average expenditure in Seattle and Portland, but $53 in Tulsa and $47 in Newark.

Similarly, additional orthopedic procedures on the day of the knee replacement added nothing in Portland, but $54 to the average in Newark. Non-orthopedic procedures added less on average: nothing in Milwaukee; only $3 and $4 in Portland and Seattle, respectively; and $28 in Newark.

We saw earlier that the use of assistant surgeons, though it varied considerably from market to market, was substantial throughout, and now we can see that they added relatively large amounts to the cost of the procedure. The range was from $134 in Milwaukee at the low end of the scale to $304 in Portland at the high end.

Finally, other post-surgery services (i.e., not visits) provided by the surgeon who performed the procedure added relatively large amounts to the total, as well. Portland surgeons received another $49 on average, while those in Newark, the highest market again, received an average of another $128.

To summarize, Milwaukee started at the low end of the scale when only the surgeon's fee was considered; and the various services we have examined added only $248 to the original $1,684. Newark started as the most expensive city of the five being considered here, when only the surgeon's fee was included, and the additional services provided to its patients added the largest amount, $542. Adding in differences in the cost of practice increased Tulsa's surgeon's fee and decreased Newark's enough that Oklahoma City became the most expensive city, and Newark, the second most expensive even though these services added more to Newark's expenditures that to Tulsa's.

4.4.4 Explaining Variations in Surgeons' Fees for Knee Replacements

As with the other orthopedic procedures, we ran regressions in an effort to explain the variations we observed in the allowed charges for surgeons performing knee replacement operations. The results are found in Table 4-12.

TABLE 4-11

ADJUSTMENTS TO SURGEON'S KNEE REPLACEMENT FEE

	Newark	Seattle	Tulsa	Portland	Milwaukee	Ratio of Highest to Lowest
Surgeon's Fee	$2,567	$2,312	$2,233	$2,077	$1,770	1.45
Surgeon's Fee (deflated)	2,166	2,068	2,422	2,056	1,684	1.44
Visits by the Surgeon (before, on day of, or after surgery)	2,213	2,083	2,475	2,071	1,710	1.45
Other Orthopedic Surgery	2,267	2,095	2,507	2,071	1,722	1.46
Other Surgery on the Same Day	2,295	2,099	2,520	2,074	1,722	1.46
Assistant Surgeons	2,580	2,372	2,736	2,378	1,856	1.47
Other Post-Surgical Services (not visits) by Surgeon	2,708	2,482	2,838	2,427	1,932	1.47
Amount Added to Surgeon's (deflated) Fee	542	414	416	371	248	

Source: Medicare Part B Claims, 10 States, 1986.

TABLE 4-12

EXPLAINING VARIATION IN KNEE REPLACEMENT FEES

	Mean	Coefficient
GPCI	.964	1144.80***
Other Surgery at the Same Time	.054	54.36***
Assistant Surgeon	.504	66.53***
Number of Same Day Visits	.050	-49.15***
Number of Preoperative Visits	.376	-15.79***
Number of Postoperative Visits	.256	-3.75*
Number of Other Same Day Services	.566	.24
Number of Presurgery Services	17.868	.01
Number of Postsurgery Services	7.549	-.02
Surgeons per Capita	.395	-67.82**
Beds per Capita	4.476	2.22
Per Capita Income (000)	13.246	0.004
Percent Population White	87.436	-0.09***
Constant	---	1751.23***
R^2	---	.15
F-ratio	---	86.85
df	---	7908

***Significant at one percent level.
**Significant at five percent level.
*Significant at ten percent level.

Source: Medicare Part B Claims, 10 States, 1986.

The GPCI was highly significant in a positive direction, just as it was with the other two orthopedic procedures. Thus, as expected, the surgeons' fees tended to be higher in markets in which physician practice costs were higher.

With the other two orthopedic procedures, the relationship between the allowed charge and bills from assistant surgeons was not significant. For knee replacements, however, it was not only significant, but in a positive direction. That means that, contrary to expectations, surgeons were not using assistants to compensate for what they considered to be low fees. Instead, they were using assistants in markets in which the fees already were high.

The same result turned out to be the case with the performance of additional surgery on the same day as the knee replacement. The relationship was both positive and significant. This result, too, was contrary to expectations since physicians were not compensating for low fees.

One possible alternative scenario is that since surgeons are attracted to cities, many of which have medical centers, which tend to be places which historically have had well insured populations, the demand for surgery has been inelastic. Moreover, these are the areas in which new procedures have been developed and introduced and the prices that were set originally were relatively high, partly because costs were hard to determine and demand was inelastic. Once having been set, moreover, they were not reduced even when it became possible to identify costs more precisely. Thus, they remained high and continued to increase with the general increase in prices. Further, the surgeons in these areas tended to be among the most aggressive and innovative -- they developed or introduced the new procedures, trained others (i.e., assistants) to perform the procedures, and did additional surgeries, as well.

On the other hand, when the new procedure was introduced into smaller markets, the prices set there may have been lower to reflect newly available information on costs and insurers' experience with the procedure as well as a less aggressive posture. Since Medicare's allowed charges reflect historical fees, these patterns in the private market may have been transported to the Medicare market. Thus, by this theory, surgeons' behavior -- at least regarding the use of assistants and the performance of additional surgeries -- tend to reflect prices less than other factors.

In contrast to the results regarding bills from assistant surgeons and the performance of additional procedures on the same day as the knee replacement, the numbers of preoperative and same-day visits by the surgeon, which also were statistically significant, were negative. This result is consistent with the view that surgeons attempted to compensate for what they considered to be low fees by billing for additional services. It is possible that surgeons in higher-fee areas also provided those visits but, satisfied with the fee or constrained by practices of the fiscal agents, did not bill separately for them.

Of the market level factors, the surgeon-population ratio was negatively associated with surgeons' fees for knee replacements, meaning that when there were more surgeons for the population in an area, the allowed charge for knee replacement operations tended to be lower.

In addition, the proportion of the population who were white also was negatively related to knee replacement fees. This result is consistent with results on the other orthopedic procedures, but is no easier to explain here as it was with them.

Altogether the factors in the equation explained only 15 percent of the variance in the surgeons' allowed charge for knee replacements. On the other hand, with only dummy variables for markets in a separate regression equation, 51 percent of the variance was explained. Clearly, more of interest is occurring in the markets than is revealed by factors in the detailed equations presented here.

5.0 GENERAL SURGICAL PROCEDURES

5.1 Introduction

Geographic variation in charges was also examined for two general surgical procedures: cholecystectomies and partial colectomies. Charges listed under three very similar cholecystectomy procedure codes (cholecystectomy, cholecystectomy with choleangiography, and cholecystectomy with exploration of common duct) were combined for the analysis of this procedure. Charges for each procedure were weighted by the national frequency of performance to eliminate inter-area variation in fees stemming from variation in procedure code mix. Only charges for one specific procedure code were used for the colectomy analysis, making weighting unnecessary.

In most market areas, we had larger sample sizes for cholecystectomies than colectomies because they are less complicated and more frequently performed surgeries. When fewer than fifty operations were performed in a market area, we excluded that market area from the analysis. Consequently, we report cholecystectomy charges for 70 market areas, but colectomy charges for only 57 market areas in Sections 5.2 and 5.3, respectively. Descriptive statistics describing variation in surgery practice patterns and billing are also shown in the next sections for representative cities. Finally, using the surgery as the unit of observation, multivariate analyses are presented for each procedure to determine which variables have statistically significant impacts on surgeons' fees.

5.2 Cholecystectomy

5.2.1 The Surgeon's Fee

Table 5-1 shows considerable variation among geographic areas in the actual mean charges allowed by Medicare for a cholecystectomy. Medicare pays as little as $583 on average in Anniston, Alabama for this surgery but as much as $1,095 in Jersey City, New Jersey (an 88 percent difference). Differences among areas in the actual allowed charge no doubt partly reflect physician practice cost differences. Indeed, the lowest average charges can be found in states like Alabama and Kansas for smaller MSAs while the highest charges are being paid in larger MSAs in New Jersey and Connecticut.

Jersey City still has the highest average charge and Anniston the lowest even after adjusting for differences in physician practice costs. However, the range between the two charges narrows somewhat from 88 percent to 63 percent. Although adjusting for practice cost differences does not change the relative ranks of these two areas, the ranks for other areas change considerably in some cases. For example, while the actual mean charge for Dothan, Alabama ($842) is close to the median, its deflated charge is third to

TABLE 5-1

MEDICARE NOMINAL AND DEFLATED ALLOWED CHARGES FOR CHOLECYSTECTOMIES BY AREA[a]

Area	Sample Size	Mean Allowed Charge Nominal	Mean Allowed Charge Deflated
Alabama			
Anniston	80	$ 583	$ 658
Birmingham	760	850	894
Dothan	115	843	1,042
Florence	107	748	898
Gasden	105	675	732
Huntsville	125	796	732
Mobile	390	790	891
Montgomery	180	824	954
Tuscaloosa	128	750	783
Rural	724	768	950
Arizona			
Phoenix	934	1,032	984
Tucson	318	954	950
Rural	329	912	986
Connecticut			
Bridgeport	217	1,012	935
Danbury	74	1,054	974
Hartford	313	921	850
Meriden-New Haven	244	983	1,019
New Britain	108	925	854
New London	81	922	863
Norwalk	50	1,032	954
Stamford	84	1,029	951
Waterbury	143	916	950
Rural	121	961	1,001
Georgia			
Albany	123	751	951
Athens	100	841	922
Atlanta	1,137	870	939
Columbia-Richland	185	854	952
Columbus	131	814	921
Macon	196	827	1,018
Savannah	170	815	941
Rural	1,215	766	986
Kansas			
Kansas City	934	831	882
Topeka	125	713	801
Wichita	246	742	747
Rural	915	745	946

TABLE 5-1 (cont'd)

MEDICARE NOMINAL AND DEFLATED ALLOWED CHARGES FOR CHOLECYSTECTOMIES BY AREA

Area	Sample Size	Mean Allowed Charge Nominal	Mean Allowed Charge Deflated
New Jersey			
Atlantic City	161	$ 979	$1,056
Jersey City	202	1,095	1,072
Middlesex-Somerset	372	1,029	887
Monmouth	631	1,011	853
Newark	863	1,064	898
Passaic-Bergen	693	1,080	934
Philadelphia	437	976	916
Trenton	163	992	902
Vineland-Millville	88	947	771
Oklahoma			
Enid	82	811	968
Oklahoma City	659	836	925
Tulsa	464	869	942
Rural	858	781	977
Oregon			
Eugene	137	889	895
Medford	85	818	810
Portland	425	882	873
Salem	163	747	846
Rural	583	805	896
Washington			
Bellingham	68	828	909
Brementon	69	853	765
Olympia	76	802	706
Seattle	729	802	718
Spokane	229	768	813
Tacoma	252	853	822
Vancouver	59	832	835
Yakima	114	744	862
Rural	499	797	805
Wisconsin			
Appleton-Oshgosh	212	698	792
Eau Claire	52	864	1,024
Green Bay	156	744	774
Madison	1,166	781	820
Milwaukee	692	812	773
Racine	85	804	810
Wausau	54	756	812
Rural	583	762	899
All Areas	23,378	856	888
Ratio of Highest to Lowest Charge	--	1.88	1.63

[a]Weighted means have been calculated across three cholecystectomy codes using national frequencies as weights.

Source: Medicare Part B Claims, 1986.

the highest ($1,042). In particular, charges in rural areas appear much higher after deflating. For example, in nominal dollars, rural areas are never the highest priced areas in a state, but after deflating, rural areas become the most expensive areas in four states (Arizona, Kansas, Oklahoma and Oregon). Arizona and Oklahoma surgeons practicing in rural areas are actually paid the least of all market areas in nominal terms but are paid the most after deflating.

Examining variation in allowed charges among the largest MSAs in each of the 10 states narrows but does not eliminate the inter-area variation. Table 5-2 shows a 33 percent difference between the highest allowed charge in Newark ($1,064) and the lowest in Seattle ($802). Adjusting for differences in practice costs in these two areas reduces the gap between these two cities only slightly (to 25 percent), and actually widens the gap among the ten cities as a whole. After deflating the highest allowed charge in Phoenix is 37 percent higher than the lowest in Seattle.

5.2.2 Variation in "Same Day" Services

Table 5-2 also shows variation in surgery practices among the 10 MSAs. For example, the surgeon performed a second operation during 34 percent of all cholecystectomies in Kansas City, but in less than two percent of cholecystectomies in Oklahoma City. Other surgeries performed with cholecystectomies include both diagnostic surgery (e.g., endoscopies and biopsies) and major surgery such as partial colectomies. Casemix differences among these large MSAs are not likely to explain such wide variation in the frequency with which additional surgeries are performed with cholecystectomies. More likely, differences among carriers in their propensity to accept bills for additional surgeries explains a good deal of the observed variation. For example, surgeons in Phoenix, Oklahoma City and Portland all have the same carrier and also perform (or at least bill for) considerably fewer additional surgeries.

Differences among the areas in the number of residents versus private practice physicians available for assisting the surgeon can account for inter-area variation in the proportion of cholecystectomies performed with an assistant surgeon. About 65 percent of cholecystectomies performed in Oklahoma City and Seattle were performed with an assistant surgeon compared to only 22 percent in Hartford. Part of this difference may reflect the relative scarcity of assistant surgeons in Hartford. However, physicians in Hartford may also tend to have a more go-it-alone practice style than those in Oklahoma City and Seattle.

TABLE 5-2

SURGEONS' FEES AND PRACTICE PATTERNS FOR CHOLECYSTECTOMY: A TALE OF TEN CITIES[a]

	Birmingham AL	Phoenix AZ	Hartford CT	Atlanta GA	Kansas City KA	Newark NJ	Oklahoma City OK	Portland OR	Seattle WA	Milwaukee WI
Surgeon's Fee	$850	$1,032	$921	$870	$831	$1,064	$836	$882	$802	$812
Surgeon's Fee (Deflated)	$894	$984	$850	$939	$882	$898	$925	$873	$718	$773
Same Day Services:										
% with other surgery by surgeon	20.4%	2.8%	11.9%	25.9%	33.9%	11.1%	1.5%	3.0%	26.8%	16.2%
% with assistant surgeon	42.0%	34.4%	21.6%	47.8%	40.8%	39.9%	64.6%	50.9%	65.8%	33.0%
No. of visits by surgeon	0.04	0.31	0.07	0.13	0.02	0.13	0.11	0.14	0.02	0.04
No. of visits by other MDs	0.53	1.28	0.58	1.12	0.55	1.03	0.74	0.75	0.53	0.19
Pre-Operative Services:										
No. of visits by surgeon	0.50	0.86	1.24	1.05	0.11	0.89	0.49	0.39	0.27	0.47
No. of visits by other MDs	4.25	2.15	3.68	2.36	2.31	2.13	1.86	1.36	1.61	2.79
Post-Operative Services, In Hospital:										
No. of visits by surgeon	0.17	0.20	0.64	0.28	0.19	0.23	0.32	0.15	0.30	0.55
No. of visits by other MDs	5.18	7.22	5.08	8.60	9.18	8.25	7.57	5.16	4.95	3.68
Post-Operative Services, Out of Hospital:										
No. of visits by surgeon	0.07	0.03	0.24	0.04	0.04	0.07	0.03	0.02	0.07	0.16
No. of visits by other MDs	0.80	0.85	0.51	0.70	0.88	0.74	0.66	0.70	0.94	0.69

[a]Weighted means have been calculated across three cholecystectomy codes using national frequencies as weights.

Source: Medicare Part B Claims, 1986.

5.2.3 Pre- and Post-Operative Services

While the allowed charge for the surgery should include in-hospital pre-operative and follow-up hospital visits (including consults) by the surgeon, there are instances when the surgeon might bill separately for some of these visits (e.g., particularly for visits to the intensive care unit). Carriers also differ as to which additional services they deem reimbursable. Thus, it is not surprising to find considerable variation among the 10 MSAs in the mean number of visits performed by the surgeon on the day of surgery. Surgeons in Phoenix bill separately for these services more often than surgeons in other areas, but even so, they only bill for three visits for every 10 cholecystectomies performed. Surgeons in all the other cities bill for fewer than 1.5 visits for every 10 cholecystectomies performed. Interestingly, surgeons in Phoenix bill separately for visits more often than other surgeons even though they receive the highest deflated charge for the surgery.

Other physicians (besides the surgeon) were much more likely to provide visits on the day of surgery in all market areas. In most cities at least 1 visit for every two cholecystectomies was made by other physicians on the day of surgery. Once again, the most visits were performed in Phoenix (1.28 visits were made by another physician for each cholecystectomy). By contrast, in Milwaukee, only about two visits were made for every 10 surgeries.

Looking at the number of separate bills for pre-operative visits (i.e., office and emergency room visits and consults during the week prior to surgery) shows that surgeons in most market areas bill for less than one such visit per cholecystectomy. However, there is tremendous range among market areas in the propensity to bill for pre-operative visits. For example, surgeons in Hartford bill for these visits more than ten times as often as surgeons in Kansas City. Other physicians bill for pre-operative visits more frequently than surgeons (between one and five visits for every surgery).

Surgeons tend to bill for post-operative visits in the hospital slightly less frequently than they do for pre-operative visits. Not surprisingly, other physicians bill between four and eight post-operative visits in the hospital per cholecystectomy. However, inter-area variation in the number of post-operative visits by other doctors most likely reflects differences in lengths of hospital stays between the areas.

Very few bills are submitted by the surgeons for post-operative care provided outside of the hospital (less than three visits for every 10 surgeries). Other physicians bill for less than one post-surgery outpatient visit per cholecystectomy in all 10 MSAs. However, even these few post-hospital visits are likely to be overestimates of surgery-related care.

Unlike most of the other surgeries, the global fee or a cholecystectomy only covers 45 days of follow-up care. However, post-hospital visit data were obtained for the full 90-day follow-up period required for most surgeries.

5.2.4 Reducing the Variation in Cholecystetcomy Fees

We examine the inter-area variation in cholecystectomy fees for five areas shown in Table 5-3. These five areas represent the range in the mean allowed charge from the highest charge in Jersey City to the second to the lowest in Gasden, Alabama. (New Britain, Connecticut; Kansas City, Kansas; and Madison, Wisconsin have mean allowed charges at the 75th, 50th and 25th percentiles, respectively.) Deflating allowed charges reduces the 62 percent difference between Gasden and Jersey City to 46 percent. Adjusting for practice cost differences, New Britain is actually less expensive than Kansas City.

Adding in deflated charges for all pre- and post-operative visits by the the surgeon actually increases the charge gap between Jersey City and Gasden from 46 percent to 52 percent. Thus, not only are surgeons paid more for a cholecystectomy in Jersey City than in Gasden, they also bill for more additional visits. By contrast, surgeons in Kansas City bill for very few additional visits and average charges for this area are even smaller than those for Madison when the costs of these services are combined.

When we account for other surgeries and services performed by the surgeon on the day of surgery, Kansas City appears to be almost as expensive as Jersey City, while New Britain becomes the least expensive area. Furthermore, the charge gap between the highest and lowest cities (i.e., Jersey City and New Britain) decreases substantially from 52 percent to 25 percent.

Including charges for other pre- and post-operative services performed by the surgeon increases fees only marginally in most cities. However, Kansas City becomes more expensive than Jersey City when these charges are included. The charge gap between Kansas City and New Britain actually widens slightly (from 25 percent to 29 percent).

Accounting for charges made by assistant surgeons increases fees more in both Jersey City and Gasden than in the other three cities. Jersey City once again appears the most expensive ($1,343 on average), but because of a very minimal increase in New Britain, the charge gap widens from 29 to 37 percent.

5.2.5 Regression Results for Cholecystectomy Fees

To test the impacts of billing and practice patterns and cost-of-living differences on geographic fee variation, we regressed cholecystectomy fees on some of the key variables discussed above, holding constant demand and casemix factors. Table 5-4 shows the results of the complete specification.

TABLE 5-3

ADJUSTMENTS TO CHOLECYSTECTOMY FEES FOR EXTRA BILLINGS AND ADDITIONAL SERVICES[a]

Charges	Jersey City NJ	New Britain CT	Kansas City KS	Madison WI	Gasden AL	Ratio of Highest to Lowest Area
Surgeon's Fee	$1,095	$ 925	$ 831	$ 781	$ 675	1.62
Surgeon's Fee (deflated)	1,072	854	882	820	732	1.46
Including Surgeons' Visits	1,144	890	895	938	755	1.52
Including Surgeon's Other Services on Day of Surgery	1,198	959	1,196	1,117	988	1.25
Including Surgeon's Other Pre- and Post-op Services	1,221	962	1,240	1,214	1,000	1.29
Including Assistant Surgeons' Fees	1,343	980	1,311	1,280	1,139	1.37

[a]Weighted means have been calculated across three cholecystectomy codes using national frequencies as weights.

Source: Medicare Part B Claims, 1986.

TABLE 5-4

REGRESSION RESULTS FOR CHOLECYSTECTOMY FEES

Variable	Mean	Coefficient
Intercept	1.00	315.90***
GPCI	0.96	619.88***
Choleangiography	0.52	108.58***
Common Duct Exploration	0.20	210.61***
Non-General Surgeons	0.07	-37.79***
Multi-Specialty Group Physicians	0.05	-68.41***
Second Surgery	0.18	-153.75***
Surgeon's Visits on Day of Surgery	0.09	21.30***
Surgeon's Pre-op Visits	0.71	6.17***
Surgeon's Post-op Visits	0.41	-2.22***
Assistant Surgeon	0.51	0.27
Beds Per 1,000 Population	4.54	-6.46***
Surgeons Per 10,000 Population	4.93	2.61***
Percent White	85.44	-2.71***
Per Capita Income (in 1000s)	13.05	10.24***
R^2	---	0.50
F-Statistic	---	1653
DF	---	23,330

***Significant at 99% confidence level.

Source: Medicare Part B Claims, 1986.

Most all the variables are significant at the 99% confidence level, and together, they explain 50 percent of the geographic variation in fees. Differences in practice costs (as measured by the GPCI) explain 18 percent of the variation alone. The mean GPCI of 0.96 indicates that cholecystectomies are more frequently performed in low cost (more rural) areas than other surgeries. The positive coefficient on the GPCI implies an elasticity of .69; thus, holding all else constant, cholecystectomies in an area ten percentage points above the mean (i.e., with a GPCI of 1.06) will be $62 more expensive on average than cholecystectomies in areas with average practice costs.

For the 10 states as a whole, 52 percent of cholecystectomies included a choleangiography and 20 percent included common duct exploration. Performing choleangiography with the cholecystectomy adds $109 to the fee while including common duct exploration increases the fee by $211. These results underscore the importance of holding procedure mix constant when comparing differences in average fees across areas.

As a group, other surgeons and physicians are paid $38 less on average than general surgeons for performing a cholecystectomy. Almost half of these physicians are medical specialists (e.g., GPs, FPs, or internists) which may explain the lower payments. The vast majority of multi-specialty group physicians performing these surgeries are probably general surgeons, yet they are also paid less on average ($68 less than non-group general surgeons). This difference may reflect Medicare payment practices or variation among carriers as to whether or not they pay physicians in multi-specialty groups differently.

As expected, performing a second surgery along with the cholecystectomy lowers the fee by $154 on average. Although the discount to the cholecystectomy would be 50 percent (or $433 for the average cholecystectomy), not all second surgeries result in discounting the cholecystectomy, particularly if they are less complex than the cholecystectomy, or if they require a second incision.

Holding constant practice cost differences and procedure mix, we would expect surgeons receiving higher global fees to submit fewer separate bills for visits during the episode of care. While the negative coefficient on post-operative visits suggests that this is the case for visits made after the surgery, it is not true for visits made on or prior to the day of surgery. Surgeons receiving higher fees for cholecystectomy are also billing for more pre-operative visits and for more visits on the day of surgery.

Holding all else constant, the presence of an assistant surgeon has no effect on the surgeon's fee. Although some surgeons perform cholecystectomies without assistance, or with the assistance of a resident, they do not charge significantly more for the service than surgeons using assistants.

While all the variables measuring demand factors are significant, they do not all have the expected sign. Using hospital beds per capita as a measure of demand, we would expect to find higher fees the more beds per capita. Instead, the fees are lower in high demand areas. Presumably, surgeons in more competitive areas will bid down surgery fees. However, the coefficient on the measure of physician competition (the number of surgeons per capita) suggests that the more surgeons available, the lower the fees. These unexpected results may reflect multi-collinearity among the two variables, however, the number of beds and surgeons are only correlated .30). On the other hand, it may suggest that surgeons do not operate in competitive markets. Holding constant per capita income, fees are lower in areas with a higher proportion of whites, probably reflecting a sicker casemix among blacks. Fees are significantly higher in high income areas, probably because these patients are more able to pay the higher fees.

5.3 Partial Colectomy

5.3.1 The Surgeon's Fee

The average Medicare payment for a colectomy ranges from only $937 in Salem, Oregon to $1,589 in Danbury, Connecticut: about a $650 (or 70 percent) difference (see Table 5-5). Again, cities in Connecticut and New Jersey are among the most expensive areas while smaller MSAs in Alabama and rural areas in Georgia and Oregon are among the cheapest.

Deflating allowed charges for colectomies reduces the difference between high and low areas by only 11 percent. As shown for cholecystectomies, rural areas do not appear as underpaid relative to big cities after adjusting for medical cost differences among the areas.

Mean allowed charges in the largest MSAs in the 10 states vary from $1,454 in Newark to $1,025 in Oklahoma City: about a 40 percent difference (see Table 5-6). Adjusting for practice costs differences, surgeons are paid the most in Birmingham for a colectomy, and they are paid the least in Portland. However, the difference between deflated charges in these two areas is only about 20 percent.

5.3.2 Variation in "Same Day" Services

As shown for cholecystectomies, surgeons performing colectomies in the three cities with the same carrier (Oklahoma City, Portland and Phoenix) tend to bill for additional surgeries much less frequently than surgeons in other cities. In these areas, additional surgeries are billed along with about 3 percent of all colectomies compared to as much as 35 percent in Kansas City (see row 3 in Table 5-6). Surgeries frequently performed with colectomies include other abdominal procedures, like cholecystectomies and enterectomies.

TABLE 5-5

MEDICARE NOMINAL AND DEFLATED ALLOWED CHARGES FOR COLECTOMIES BY AREA

Area	Sample Size	Mean Allowed Charge Nominal	Mean Allowed Charge Deflated
Alabama			
Birmingham	237	$1,185	$1,245
Dothan	54	1,099	1,359
Gasden	59	954	1,034
Huntsville	65	1,187	1,092
Mobile	144	1,120	1,263
Montgomery	72	1,169	1,353
Tuscaloosa	69	944	985
Rural	199	1,098	1,357
Arizona			
Phoenix	488	1,294	1,234
Tucson	204	1,225	1,219
Rural	121	1,127	1,218
Connecticut			
Bridgeport	143	1,367	1,264
Danbury	63	1,589	1,469
Hartford	244	1,195	1,104
Meriden-New Haven	132	1,323	1,371
Middletown	54	1,032	953
New London	52	1,116	1,045
Stamford	75	1,585	1,465
Waterbury	99	1,219	1,263
Rural	101	1,138	1,186
Georgia			
Atlanta	407	1,110	1,198
Columbia-Richland	60	1,043	1,162
Macon	77	1,030	1,269
Savannah	67	1,018	1,175
Rural	363	978	1,259
Kansas			
Kansas City	455	1,071	1,137
Topeka	96	1,019	1,144
Wichita	107	1,021	1,029
Rural	426	1,012	1,286

TABLE 5-5 (cont'd)

MEDICARE NOMINAL AND DEFLATED ALLOWED CHARGES FOR COLECTOMIES BY AREA

Area	Sample Size	Mean Allowed Charge	
		Nominal	Deflated
New Jersey			
Atlantic City	126	1,185	1,279
Jersey City	100	1,487	1,455
Middlesex-Somerset	240	1,374	1,185
Monmouth	341	1,404	1,183
Newark	525	1,454	1,227
Passaic-Bergen	400	1,480	1,281
Philadelphia	256	1,290	1,211
Trenton	152	1,364	1,240
Oklahoma			
Oklahoma City	298	1,025	1,134
Tulsa	155	1,101	1,194
Rural	234	1,024	1,280
Oregon			
Eugene	63	1,012	1,019
Medford	63	990	981
Portland	263	1,058	1,047
Salem	83	937	1,061
Rural	276	983	1,094
Washington			
Olympia	59	1,053	926
Seattle	428	1,178	1,054
Spokane	136	1,013	1,073
Tacoma	165	1,089	1,049
Yakima	62	1,063	1,232
Rural	199	1,071	1,082
Wisconsin			
Appleton-Oshkosh	169	1,043	1,182
Green Bay	71	1,019	1,060
Madison	645	1,090	1,145
Milwaukee	430	1,173	1,116
Racine	65	1,135	1,144
Rural	313	1,078	1,268
All Areas	11,050	1,148	1,181
Ratio of Highest to Lowest Charge Area	--	1.70	1.59

Source: Medicare Part B Claims, 1986.

TABLE 5-6

SURGEONS' FEES AND PRACTICE PATTERNS FOR COLECTOMY: A TALE OF TEN CITIES

	Birmingham AL	Phoenix AZ	Hartford CT	Atlanta GA	Kansas City KA	Newark NJ	Oklahoma City OK	Portland OR	Seattle WA	Milwaukee WI
Surgeon's Fee	$1,184	$1,294	$1,195	1,110	$1,071	$1,454	$1,025	$1,058	$1,178	$1,173
Surgeon's Fee (Deflated)	1,245	1,234	1,104	1,198	1,137	1,227	1,134	1,047	1,054	1,116
Same Day Services:										
% with other surgery by surgeon	26.2%	3.1%	16.0%	28.3%	34.9%	12.6%	2.7%	0.8%	26.2%	22.6%
% with assistant surgeon	54.9%	38.7%	20.1%	36.4%	33.6%	33.9%	47.0%	46.4%	63.8%	32.8%
No. of visits by surgeon	0.00	0.17	0.05	0.08	0.09	0.11	0.08	0.07	0.05	0.02
No. of visits by other MDs	0.57	1.22	0.65	0.97	1.00	0.96	0.76	0.69	0.60	0.37
Pre-Operative Services:										
No. of visits by surgeon	0.69	1.06	1.20	1.10	0.11	1.07	0.60	0.36	0.26	0.47
No. of visits by other MDs	4.52	2.41	3.69	2.17	2.49	2.14	2.21	1.73	1.70	3.31
Post-Operative Services, In Hospital:										
No. of visits by surgeon	0.49	0.41	1.25	0.22	0.51	0.72	0.37	0.05	0.39	0.43
No. of visits by other MDs	8.89	10.69	9.20	10.89	12.21	10.70	10.10	7.07	7.92	5.48
Post-Operative Services, Out of Hospital:										
No. of visits by surgeon	0.12	0.05	0.41	0.04	0.12	0.17	0.08	0.08	0.20	0.24
No. of visits by other MDs	1.57	1.79	1.29	1.46	1.16	1.57	1.59	1.27	1.85	1.34

Source: Medicare Part B Claims, 1986.

However, in Portland where few other surgeries were performed at all, no cholecystectomies were performed with colectomies, while in Birmingham and Kansas City they were performed in 5 percent of all colectomy cases. No enterectomies were performed with colectomies in Portland, Oklahoma City or Phoenix, but they were performed during 4 percent of all colectomies in Seattle. However, surgeons in Portland, Oklahoma City and Phoenix do tend to perform colonoscopies and other diagnostic surgery on the same day as the colectomies more frequently than do surgeons elsewhere.

In most areas, between 30 and 50 percent of colectomies were performed with an assistant surgeon. However, in Hartford, only 20 percent were performed with an assistant surgeon while in Seattle 64 percent were performed with an assistant. In both of these cities, assistant surgeons are used at about the same rate for cholecystectomies and colectomies.

Colectomy surgeons rarely billed for a visit on the day of surgery in all ten areas. No visits were billed by the surgeon on the day of surgery in Birmingham and as many as 17 visits for every 100 colectomies were billed in Phoenix. However, other physicians frequently bill for a visit on the day of surgery. Table 5-6 shows that in Phoenix, other physicians bill an average 1.22 visits per colectomy compared to only .37 (or one visit for every three colectomies) in Milwaukee.

Colectomy surgeons bill separately for pre-operative visits with about the same frequency as cholecystectomy surgeons. Again, Hartford surgeons bill for these services most frequently (1.2 visits per surgery) while surgeons in Kansas City bill for them only infrequently (0.11 visit per surgery).

Surgeons vary tremendously among the 10 MSAs in their propensity to bill for in-hospital post-operative visits. Surgeons in Hartford bill for these services twenty-five times as often as surgeons in Portland (1.25 visits per colectomy, compared to only .05 in Portland). Other physicians provide between 5 and 12 post-operative visits for each colectomy, probably depending on variation in lengths of stay among the areas.

Surgeons rarely bill for post-hospital visits, probably because they are including them in the global fee. At least one post-hospital visit per colectomy is billed by a physician other than the surgeon in all areas.

5.3.3 <u>Reducing the Variation in Colectomy Fees</u>

Table 5-7 shows various mean charges for 5 cities representing the range in nominal allowed charges for a colectomy. The ratio of the third to the highest charge in Jersey City to the lowest charge in Salem, Oregon is 1.59. Charges in Hartford, Madison, and Oklahoma City are at roughly the 75th, 50th and 25th percentiles, respectively. Deflating the charges reduces the 59 percent difference between Jersey City and Salem to 37 percent.

TABLE 5-7

ADJUSTMENTS TO COLECTOMY FEES FOR EXTRA BILLINGS AND ADDITIONAL SERVICES

Charges	Jersey City NJ	Hartford CT	Madison WI	Oklahoma City OK	Salem OR	Ratio of Highest to Lowest Area
Surgeon's Fee	$1,487	$1,195	$1,090	$1,025	$937	1.59
Surgeon's Fee (deflated)	1,455	1,104	1,145	1,134	1,061	1.37
Including Surgeons' Visits	1,552	1,190	1,281	1,176	1,080	1.44
Including Other Services on Day of Surgery	1,609	1,264	1,418	1,189	1,094	1.47
Including Surgeon's Other Pre- and Post-op Services	1,707	1,389	1,643	1,287	1,194	1.43
Including Assistant Surgeons' Fees	1,839	1,433	1,738	1,392	1,365	1.35

Source: Medicare Part B Claims, 1986.

Including separate charges for any visits provided by the surgeon increases mean charges in Salem only marginally (by $19 on average), but increases them by as much as $136 in Madison. Because of the small increase in Salem, the ratio of the high-to-low charges increases from 1.37 to 1.44.

Accounting for other surgeries performed with the colectomy widens the charge gap slightly further to 1.47. Again this is chiefly due to few additional surgeries being performed (or at least billed) in Salem than in other areas.

Including charges for other pre- and post-operative services performed by the surgeon narows the charge gap from 47 to 43 percent. For most cities, adding in the bills for these services increases outlays by only about $100, however in Madison, these services average $225 per colectomy.

Adding charges by assistant surgeons to the total surgeon fees increases the amount spent in Salem considerably more than the amount spent in the more populous cities. No doubt the greater availability and use of residents in the more populous areas reduces average costs for assistant surgeons. Consequently, the charge gap shrinks from 43 percent to 35 percent when accounting for assistant surgeon fees.

5.3.4 Regression Results for Colectomy Fees

Table 5-8 shows the results of regressing fees on variables measuring variation in practice costs, practice patterns, and billing patterns, holding constant demand and casemix factors. Nearly all the variables are significant and they explain 47 percent of the geographic variation in fees.

Regressing fees on the GPCI alone explains 41 percent of the geographic variation. Evaluated at their means, every one percent increase in the GPCI, increases fees by 0.89 percent (1,057 (.98/1167)=.89). For example, colectomies performed in an area where practice costs are 10 percentage points higher than the mean (i.e., with a GPCI of 1.08) are $106 more expensive on average.

General surgeons receive $68 more than multi-specialty group physicians for performing a colectomy, and they receive $70 more on average than other surgeons. Although these findings are similar to those for cholecystectomies, the relative difference between multi-specialty group members and other general surgeons is smaller for colectomy fees.

For the 25 percent of colectomy surgeries that included a second surgery, the fee was $36 less on average. Although statistically significant, the magnitude of the average discount is quite small relative to the average fee for a colectomy ($1,167). This suggests that only a small number of more expensive surgeries are performed with colectomies and that the colectomy fees are rarely discounted.

As was found for cholecystectomy surgeons, colectomy surgeons tend to bill for more visits prior to and on the day of surgery when the global fee is

TABLE 5-8

REGRESSION RESULTS FOR COLECTOMY FEES

Variable	Mean	Coefficient
Intercept	1.0	297.48***
GPCI	0.98	1,057.23***
Non-General Surgeons	0.08	-69.96***
Multi-Specialty Group Physicians	0.06	-67.78***
Second Surgery	0.25	-29.86***
Surgeon's Visits on Day of Surgery	0.06	9.70***
Surgeon's Pre-op Visits	0.79	9.94***
Surgeon's Post-op Visits	0.73	0.65
Assistant Surgeon	0.49	-9.58***
Beds Per 1,000 Population	4.48	-3.81***
Surgeons Per 10,000 Population	5.25	-0.41
Percent White	86.95	-3.94***
Per Capita Income (in 000s)	13.17	15.42***
R^2	---	0.47
F-Statistic	---	820.73
DF	---	11,037

***Statistically significant at 99 percent confidence level.
**Statistically significant at 95 percent confidence level.

Source: Medicare Part B Claims, 1986.

higher. Although the coefficient on the number of post-op visits is also positive, it is not significant. The 49 percent of colectomy surgeons using an assistant surgeon do charge less than surgeons performing colectomies alone or with residents, but only by a meager $10.

Three of the four demand and casemix variables have the expected sign. However, the expected positive coefficient on surgeons per capita is not statistically significant. As for cholecystectomies, areas with more beds have lower fees suggesting that collinearity with surgeons per capita may be affecting the sign on this variable.

6.0 SYNTHESIS

6.1 Summary of Descriptive Results

Much of this report concerns the geographic variation of allowed charges paid to surgeons for each of eight common surgical procedures. We have addressed the question primarily by comparing results on a number of key factors across market areas in ten states for each of the eight procedures separately. But it is equally important to know the extent to which the variation observed for individual procedures also reflects the effects of markets either for particular categories of surgery (e.g., cardiovascular or orthopedic surgery) or for surgery in general.

The question is important for policy makers because if it turned out that the patterns we observed applied to all surgery (assuming these eight procedures were representative of all surgery), then a single set of pricing policies could be designed to achieve Medicare goals. If, instead, the findings suggested separate markets for orthopedic surgery, cardiovascular surgery, and general surgery, then policies could be developed for each group of procedures. Finally, if it appeared that the 8 procedures differ from one another in important ways, then, it may be necessary for Medicare policymakers to treat each one separately.

To answer the question, we constructed summary tables across all eight procedures in the ten largest markets for four different variables: an index of procedure-specific deflated charges, the mean number of visits billed, the proportion of cases with second surgeries, and the percent of cases in which the surgeon had an assistant surgeon (Tables 6-1 through 6-4).

6.1.1 The Deflated Allowed Charge Index

The mean deflated allowed charge for each market represents the geographic variation in surgical fees paid under Part B of Medicare for eight common surgical procedures. In order to get a clearer idea of the relationship of charges for one procedure to those for another, we constructed an index of the mean deflated allowed charges by dividing each market's mean fee by the overall mean. For the ten large cities discussed in Chapters 3, 4, and 5, the results are presented in Table 6-1. Thus, for example, in Birmingham the mean deflated allowed charge for CABG was 84 percent of the mean for CABG over all of the markets, while in Newark, it was 122 percent of the overall mean. Similarly, for hip replacements, the mean in Birmingham was 115 percent of the mean of means, while the result in Newark was 87 percent of the same figure.

Over the eight procedures and ten large markets, we can see a considerable similarity within types of procedures and some, but less, across those categories (that is, across all eight procedures). Thus, the mean

TABLE 6-1

PROCEDURE-SPECIFIC DEFLATED ALLOWED CHARGE INDEX VALUES FOR LARGEST MSA IN TEN STATES

	Cardiovascular Procedures			Orthopedic Procedures			General Procedures	
MSA	CABG	Pacemaker	Thromboendar-terectomy	Hip Fracture	Hip Replacement	Knee Replacement	Cholecystectomy	Colectomy
Birmingham	0.84	1.02	0.69	1.04	1.15	1.15	1.01	1.05
Phoenix	0.97	1.07	1.10	1.03	1.03	0.99	1.11	1.04
Hartford	1.05	0.94	0.83	0.91	0.97	0.89	0.96	0.93
Atlanta	0.89	1.17	1.10	1.16	1.09	1.03	1.06	1.01
Kansas City	0.88	1.07	1.00	1.06	0.97	1.05	0.99	0.96
Newark	1.22	1.12	1.02	1.07	0.87	0.95	1.01	1.04
Oklahoma City	1.11	1.02	1.09	0.98	0.92	0.82	1.04	0.96
Portland	0.98	0.55	1.04	0.99	0.95	0.90	0.98	0.89
Seattle	0.98	0.74	0.97	0.98	0.87	0.91	0.81	0.89
Milwaukee	1.06	0.54	0.75	0.92	0.71	0.74	0.87	0.94

[a]The index was calculated for each procedure by dividing the mean for the particular market in question by the mean of means for all markets.

Source: Medicare Part B Claims, 10 States, 1986.

deflated fee in Milwaukee was less than the overall mean for seven of the eight procedures; and in some cases, was quite a bit below the all-market mean. The mean deflated surgeon's fee in Milwaukee for pacemaker insertion, for example, was 54 percent of the pacemaker mean; and 71 percent of the mean for hip replacement. In fact, Milwaukee had the lowest or next-to-lowest mean deflated fee for all three orthopedic procedures and for three of the other five procedures. Seattle was always below the procedure mean and, except for CABG surgery, was among the lowest three means. At the other end of the spectrum, Birmingham and Newark were above the procedure means for six of the eight procedures. For four of the procedures Newark had the highest or next-to-highest fee; and for three, Birmingham was also in the first or second position.

6.1.2 Mean Number of Surgeon's Visits

Data from Part B Medicare claims in the ten states in the study include information on visits and other services provided by the principal surgeon and other physicians for a period beginning seven days prior to the surgery and extending 90 days following the surgery. Analyses were performed to determine the extent to which these other services were provided and whether they were influenced by the fee Medicare paid to the surgeon.

When we look at the mean number of visits by the surgeon who performed the operation, we see that, with the exception of hip fracture surgery, Birmingham was near the bottom of the list of ten cities and Newark was near the top. (See Table 6-2.) In this case, however, the pattern seems to be stronger within groups of procedures. Thus, for orthopedic procedures, Newark and Atlanta were at the top of the list, while Oklahoma City and Portland were near the bottom. For the general surgical procedures, Hartford and Milwaukee surgeons billed for the most visits, and Portland and Birmingham, for the fewest.

6.1.3 Use of Assistant Surgeons

In some cases, the principal surgeon was helped by an assistant surgeon who submitted a separate bill and was paid an amount equal to 20 percent of the surgeon's fee. Although patterns appear across all procedures, they seem to be strongest within each of the three surgery groups. (See Table 6-3.) Birmingham's cardiac surgeons were least likely among cardiac surgeons in the ten cities to use assistants, their orthopedic surgeons were in the middle among orthopedists, and their general surgeons tended to be more likely to use assistants than other general surgeons. On the other hand, with the exception of CABG procedures and pacemaker insertions, Hartford surgeons were least likely among surgeons in the ten cities to use assistants across all procedures. With two different exceptions, Milwaukee surgeons were also among

TABLE 6-2

MEAN NUMBER OF VISITS BILLED FOR EIGHT SURGICAL PROCEDURES IN LARGEST MSA IN TEN STATES

	Cardiovascular Procedures			Orthopedic Procedures			General Procedures	
MSA	CABG	Pacemaker*	Thromboendar-terectomy	Hip Fracture	Hip Replacement	Knee Replacement	Cholecystectomy	Colectomy
Birmingham	0.19	1.09	0.61	1.56	0.77	0.72	0.28	0.69
Phoenix	0.90	2.17	1.49	1.14	1.05	1.17	0.54	0.75
Hartford	0.79	1.83	0.82	1.06	1.54	1.92	0.95	1.91
Atlanta	1.03	2.95	1.76	1.15	1.08	1.68	0.46	0.42
Kansas City	0.08	1.26	0.47	0.46	0.46	1.29	0.25	0.79
Newark	0.68	2.92	1.07	1.92	1.60	1.92	0.43	1.12
Oklahoma City	0.39	3.20	0.85	0.63	0.73	0.58	0.46	0.59
Portland	0.14	4.99	0.94	0.65	0.52	0.55	0.31	0.28
Seattle	0.21	2.99	0.61	0.69	1.08	0.84	0.39	0.70
Milwaukee	0.03	3.39	0.61	0.80	0.59	1.38	0.77	0.82

*Includes visits by team physicians.

Source: Medicare Part B Claims, 10 States, 1986.

TABLE 6-3

PERCENT OF CASES WITH AN ASSISTANT SURGEON FOR EIGHT SURGICAL PROCEDURES IN LARGEST MSA IN TEN STATES

	Cardiovascular Procedures			Orthopedic Procedures			General Procedures	
MSA	CABG	Pacemaker*	Thromboendar-terectomy	Hip Fracture	Hip Replacement	Knee Replacement	Cholecystectomy	Colectomy
Birmingham	28.6%	0.6%	20.9%	13.0%	39.1%	41.2%	42.0%	54.9%
Phoenix	51.9	9.1	42.9	29.5	43.4	41.4	34.4	38.7
Hartford	93.1	8.7	19.1	5.0	21.5	17.4	21.6	20.1
Atlanta	32.5	4.9	72.1	6.6	30.4	41.7	47.8	36.4
Kansas City	86.4	5.6	51.8	8.7	39.8	44.5	40.8	33.6
Newark	31.0	27.1	51.6	36.5	55.1	66.7	39.9	33.9
Oklahoma City	86.6	3.6	80.8	5.2	28.5	19.7	64.6	47.0
Portland	73.7	16.2	57.2	34.1	74.8	74.5	50.9	46.4
Seattle	65.0	17.7	74.4	41.2	63.7	64.7	65.8	63.8
Milwaukee	10.6	68.7	33.9	19.3	27.6	36.4	33.0	32.8

*Includes use of team approach to pacemaker insertion.

Source: Medicare Part B Claims, 10 States, 1986.

the least likely to use assistant surgeons. Yet, while Oklahoma City orthopedists were unlikely to use assistants, their general surgeon colleagues were among the most likely to do so.

6.1.4 Additional Surgical Procedures

Sometimes a second surgical procedure was performed on the same day as the primary surgery. When it was done in the same incision as the principal operation, the surgeon's fee for the second procedure is reduced by 50 percent.

More consistency appears to have been the case among the large cities in the likelihood that a second surgical procedure was performed on the same day as the primary surgery (Table 6-4). Thus, Oklahoma City and Portland surgeons were relatively unlikely to have performed a second procedure regardless of what the primary operation was. On the other hand, Kansas City and Hartford surgeons were among the most likely to have performed a second billed operation for five of the eight procedures, and in the middle of the rankings for the others.

6.2 Correlation Coefficients

Examination of Tables 6-1 through 6-4 leaves us with a basis for believing that patterns do exist across procedures and, thus, that to some degree it may be useful to think of geographic markets for surgery that are larger than the market for a single type of procedure. In some cases, the patterns are stronger within groups (i.e., cardiovascular, orthopedic, and general surgeries), and in others, they appear relatively strong across all surgeries. These are not perfect relationships, however, and exceptions can be observed. Partly as a result, therefore, it is difficult to grasp the meaning in a comprehensible way when we are looking at 80 cells in each of four tables. To get a better fix on the extent of these patterns, rank-order correlations were run with the market as the unit of analysis. The question being asked was: To what extent are the results for the ten markets similar across procedures?

We constructed two tables showing correlation coefficients across markets on each variable (Table 6-5 and 6-6). The first set correlated separately cardiovascular procedures, orthopedic procedures, and general procedures; and the second, all eight procedures.

In each case, the number in the cell is a measure of the strength and direction of the relationship between the ten large markets for the two procedures in question. If the number were 1, the correlation among markets for the two procedures would be perfect; so the closer the number is to 1, the more similar the markets are for those two procedures. (Note that, in each table, most cells were left blank for either of two reasons: First, when a procedure is compared to itself, obviously the correlation is 1.0; in these

TABLE 6-4

PERCENT OF CASES WITH SECOND SURGERY FOR EIGHT SURGICAL PROCEDURES IN LARGEST MSA IN TEN STATES

	Cardiovascular Procedures			Orthopedic Procedures			General Procedures	
MSA	CABG	Pacemaker	Thromboen-darterectomy	Hip Fracture	Hip Replacement	Knee Replacement	Cholecystectomy	Colectomy
Birmingham	15.3%	1.8%	10.1%	5.5%	4.2%	3.9%	20.4%	26.2%
Phoenix	0.9	0.6	1.1	0.9	0.6	1.2	2.8	3.1
Hartford	32.1	1.8	10.3	6.4	6.8	3.0	11.9	16.0
Atlanta	21.5	0.2	3.9	4.2	3.7	5.0	25.9	28.3
Kansas City	11.7	0.5	9.5	5.8	9.7	8.4	33.9	34.9
Newark	1.8	0.5	1.2	2.4	1.4	3.9	11.1	12.6
Oklahoma City	0.8	1.5	1.4	1.0	0.3	0.0	1.5	2.7
Portland	0.7	1.1	1.4	0.3	1.4	0.0	3.0	0.8
Seattle	15.5	2.4	3.2	3.5	5.3	2.9	26.8	26.2
Milwaukee	12.1	0.0	10.5	4.2	3.6	3.7	16.2	22.6

Source: Medicare Part B Claims, 10 States, 1986.

TABLE 6-5

CORRELATION COEFFICIENTS WITHIN CARDIOVASCULAR, ORTHOPEDIC, AND GENERAL SURGERY GROUPS ON SELECTED VARIABLES

		Cardiovascular Procedures				Orthopedic Procedures				General Procedures	
		CABG	***PACE***	***THROMB***		***HIP FX***	***HIP REP***	***KNEE REP***		***CHOLE***	***COLEC***
Deflated	***CABG***	..	-.23	.05	***HIP FX***	..	.44	.79	***CHOLE***	..	.76
Allowed	***PACE***		..	.55	***HIP REP***		..	.73	***COLEC***		..
Chg. Index	***THROMB***			..	***KNEE REP***			..			
		CABG	***PACE***	***THROMB***		***HIP FX***	***HIP REP***	***KNEE REP***		***CHOLE***	***COLEC***
Percent with	***CABG***	..	-.30	.27	***HIP FX***	..	.83	.76	***CHOLE***	..	.83
Assistant	***PACE***		..	-.09	***HIP REP***		..	.92	***COLEC***		..
Surgeon	***THROMB***			..	***KNEE REP***			..			
		CABG	***PACE***	***THROMB***		***HIP FX***	***HIP REP***	***KNEE REP***		***CHOLE***	***COLEC***
Number	***CABG***	..	-.21	.78	***HIP FX***	..	.71	.48	***CHOLE***	..	.40
of	***PACE***		..	.24	***HIP REP***		..	.61	***COLEC***		..
Visits	***THROMB***			..	***KNEE REP***			..			
		CABG	***PACE***	***THROMB***		***HIP FX***	***HIP REP***	***KNEE REP***		***CHOLE***	***COLEC***
Percent with	***CABG***	..	.15	.66	***HIP FX***	..	.85	.70	***CHOLE***	..	.94
Second	***PACE***		..	-.05	***HIP REP***		..	.61	***COLEC***		..
Surgery	***THROMB***			..	***KNEE REP***			..			

Source: Medicare Part B Claims, 10 States, 1986.

tables, we used•• for those cells. And secondly, since the bottom half of the table would be exactly the same as the top half, only the cells in the top half are filled to make the table easier to read.)

Looking first at the cardiovascular procedures, we see correlations of .55 or better in only three of the 12 cells. In five cases, the correlation was actually negative, and in most other instances it was small. In only three instances, all involving thromboendartarectomy, was the correlation at all respectable. On the basis of these results, it is hard to argue the existence of a coherent market for cardiovascular surgery.

Turning to the orthopedic procedures, however, a very different story emerged. There we found correlations of .61 or better in 10 the 12 cells, and the remaining correlations, at just below .50, were still strongly positive. Particularly strong were the probabilities that another surgeon would bill as an assistant on the surgery and that additional surgical procedures would be performed on the same day as the principal surgery. In the first case, the correlations ranged from .76 to .92; and in the second, from .61 to .85.

Similarly strong correlations were observed between the two general surgical procedures. On three of the four variables, they ranged from .76 to .94. On the other hand, since only two procedures performed by general surgeons were included in the study, we are somewhat less confident in saying that the observed patterns of behavior mean that they reflect a market for general surgical procedures.

Given these results, it is not surprising that the case was not strong for arguing that surgeons behaved similarly irrespective of the type of surgery being performed or the location in which it was occurring (Table 6-6). Thus, for example, in only 47 of 112 cells across the four variables and eight surgical procedures did we find a correlation of .50 or better. The results were strongest for the likelihood that a second surgical procedure would be performed (20 of 28 cells had a correlation of .50 or better; and 16 of them were .65 or better) and the deflated allowed charge index, where a correlation of .50 or better was found in half of the cells.

When the cardiovascular procedures were removed from consideration, the results improved for all variables except the number of visits billed. In fact, the correlation coefficients among procedures for the likelihood of having a second surgical procedure were .61 or better in all ten cells; and the coefficients for the fee index were .52 or better in eight of the ten cells.

It appears from these results that there is a basis for believing that patterns do exist across procedures, particularly within the orthopedic and general surgery groups. On the other hand, we did not observe recognizable patterns of behavior among cardiovascular surgeons.

TABLE 6-6

CORRELATION COEFFICIENTS ACROSS ALL PROCEDURES ON SELECTED VARIABLES

		CABG	PACE	THROMB	HIP FX	HIP REP	KNEE REP	CHOLE	COLEC
Defl. Allowed Chg. Index	CABG	..	-.23	.05	-.42	-.79	-.80	-.21	-.28
	PACE		..	.55	.83	.49	.65	.77	.71
	THROMB			..	.42	.18	.07	.70	.13
	HIP FX				..	.44	.79	.61	.64
	HIP REP					..	.73	.59	.52
	KNEE REP						..	.44	.62
	CHOLE							..	.76
	COLEC								..

		CABG	PACE	THROMB	HIP FX	HIP REP	KNEE REP	CHOLE	COLEC
Percent with Assistant Surgeon	CABG	..	-.30	.27	-.44	-.08	-.16	.16	-.07
	PACE		..	-.09	.67	.31	.38	-.27	-.30
	THROMB			..	.16	.38	.39	.85	.53
	HIP FX				..	.83	.76	.25	.39
	HIP REP					..	.92	.49	.53
	KNEE REP						..	.42	.28
	CHOLE							..	.83
	COLEC								..

		CABG	PACE	THROMB	HIP FX	HIP REP	KNEE REP	CHOLE	COLEC
Percent with Second Surgery	CABG	..	.15	.66	.79	.73	.52	.65	.69
	PACE		..	-.05	.03	.19	-.45	-.05	-.16
	THROMB			..	.82	.67	.43	.55	.55
	HIP FX				..	.85	.70	.67	.75
	HIP REP					..	.61	.86	.79
	KNEE REP						..	.74	.85
	CHOLE							..	.94
	COLEC								..

		CABG	PACE	THROMB	HIP FX	HIP REP	KNEE REP	CHOLE	COLEC
Number of Visits by Surgeon	CABG	..	-.21	.78	.52	.74	.38	.44	-.02
	PACE		..	.24	-.35	-.22	-.32	.22	-.39
	THROMB			..	.47	.46	.16	.38	-.29
	HIP FX				..	.71	.48	.21	.21
	HIP REP					..	.61	.42	.38
	KNEE REP						..	.48	.74
	CHOLE							..	.40
	COLEC								..

Source: Medicare Part B Claims, 10 States, 1986.

6.3 Summary of Regression Results

From the results presented to this point, we believe that it is reasonable in many instances to talk about markets for orthopedic procedures or general surgery. Apparently, surgeons and patients behaved similarly to a measureable degree regarding certain dimensions of the process leading to orthopedic or general surgical procedures. The picture of a market for surgery in general was much less compelling, however, when cardiovascular procedures were included.

To what extent are the forces that explained the observed behaviors similar across procedures? This question was answered by summarizing in a single table the regression results presented in Chapters 3, 4, and 5 for each of the eight procedures. For each of the factors found in all of the regression equations, the direction of those relationships that were statistically significant at the .05 level or better was entered in the cells of Table 6-7. The actual coefficients were omitted since the values had meaning primarily in the separate equations and not across equations.

The Geographic Practice Cost Index (GPCI) had a positive, statistically significant effect in all eight regressions. Higher surgical fees were due in large part to relatively higher physician practice costs, as expected.

In six of the eight procedures, the effect of additional surgery performed on the day of the principal surgery was to reduce the surgical fee. When another surgical procedure was performed at the same incision, the fee Medicare paid was half of the allowed charge for the procedure. In some instances, it is possible that the procedure we counted as the primary procedure (because it was one of the eight operations we were studying) was considered to be the secondary procedure by the carrier paying the surgeon's bill. Alternatively, the results were also consistent with the possibility that they performed additional procedures (some of which may have been minor and may have been associated with the primary operation) in order to compensate for what they considered to be low Medicare fees for the primary procedures. The two joint replacements are exceptions to this rule. The relationship of additional surgery to the allowed charge for hip replacements was not statistically significant; and that for knee replacements was positive (that is, when the fee was higher, additional surgery was more likely to be performed). While the explanation for this finding is not obvious, it can be pointed out that the regression equations for the two joint replacements explained far less of the variance in surgical fees than those for any of the other procedures.

Earlier we saw that surgeons rarely billed for visits with the patients, probably because surgeons' visits were to be included in the global fee for the operation itself. Yet, for almost all procedures, bills for visits on the day of the surgery and prior to it were positively related to the surgeon's fee. That means that surgeons tended to bill for those visits in areas in

TABLE 6-7

SUMMARY OF STATISTICALLY SIGNIFICANT REGRESSION RESULTS[a]

	CABG	Pacemaker	Thromboendarterectomy	Hip Fracture	Hip Replacement	Knee Replacement	Cholecystectomy	Colectomy
GPCI	+	+	+	+	+	+	+	+
Other Surgery, Same Day	–	–	–	–	n.s.	+	–	–
Visits by Surgeon, Day of Surgery	+	+	n.s.	+	+	–	+	+
Visits by Surgeon, Prior to Surgery	+	+	+	+	+	–	+	+
Visits by Surgeon, After Surgery	n.s.	–	–	n.s.	–	n.s.	–	+
Assistant Surgeon	–	n.s.	n.s.	n.s.	n.s.	+	n.s.	–
Surgeons per Capita	n.s.	–	–	–	+	–	+	n.s.
Hospital Beds per Capita	+	+	–	–	n.s.	n.s.	–	–
Per Capita Income	+	+	+	+	–	n.s.	+	+
Percent White	+	–	+	–	–	–	–	–
R-square	.56	.46	.40	.45	.10	.15	.50	.47

N.S. Indicates that the results were not statistically significant at the .05 level or better.

[a]Regressions found in Chapters 3, 4, and 5 included other variables. Only those included in the equations for all 8 procedures are presented here, but the regression summaries at the foot of the table include the full equations.

Source: Medicare Part B Claims, 10 States, 1986.

which the fee was already high relative to the fee in other areas. It may be that fees tend to be high in areas to which, historically, surgeons have been drawn (largely urban, with social amenities, good schools, medical colleagues). Surgeons may have been able to set relatively high fees there because the demand has been relatively high, partly because the population has tended to be well insured. Since Medicare fees originally, at least, reflected physician charges in the private market, today's fees may still be reflecting those historic patterns. Similarly, the tendency to bill for additional visits may reflect economic factors less than historic practice patterns. It is also possible that bills for visits in the seven days prior to the surgery may have been submitted prior to the bill for the operation itself and, perhaps, even before the decision to have the procedure was made. Again, knee replacements represent an exception. Surgeons' visits prior to and on the day of the surgery were negatively associated with the surgeon's fee. When the latter was higher, fewer visits were billed; when it was relatively lower, surgeons tended to bill for more visits, possibly to compensate for what they considered to be low Medicare fees.

Visits by the surgeon on the days and weeks after the surgery tended to have either a negative or statistically non-significant relationship to the surgical fee. A negative relationship suggests that surgeons use a shorter follow-up period for their global fee in areas where fees are relatively lower, i.e., surgeons bill for more post-operative visits where surgical fees are low, holding other factors constant.

Somewhat surprisingly, the presence of an assistant surgeon who submitted a separate bill was statistically significant in only three of the eight procedures. In two cases, the sign was negative and in one, positive. For CABG surgeries and colectomies, assistant surgeon bills were associated with lower fees; for knee replacements, with higher fees. The use of assistant surgeons as a means to increase productivity was consistent with the negative signs found for CABG surgeries and colectomies. The positive sign associated with knee replacements was counter-intuitive; but as we saw earlier, knee replacements tended to exhibit different patterns on a number of dimensions. For the other five procedures, the absence of statistical signficance meant that bills from assistant surgeons had no consistent or stable relationship to the allowed charges for the surgery.

When we turned to factors found in the market environment, the results were inconsistent. It might have been expected that fees would tend to be lower in areas with more surgeons per capita due to increased competition among surgeons. That relationship was found in only four of the eight procedures (pacemaker, thromboendartarectomy, hip fractures, and knee replacements). A positive relationship was found in connection with hip replacements and cholecystectomies, and statistically non-significant relationships for CABG surgeries and colectomies.

If more surgery were done in areas with more hospital beds per capita, one partial explanation may be the hospitals' need to fill their beds. But what should the relationship be between the presence of hospital beds and surgeons' fees? If there were more beds in areas with higher amounts of insurance (more populous, more industrialized, better educated), then the surgeons' fees may also have been higher because demand was relatively high. That may have been the case with CABG surgeries and pacemakers because the signs in the regressions were positive. On the other hand, negative signs were found for four other procedures (thromboendartarectomy, hip fractures, cholecystectomy, and colectomy). The relationship was not significant for either of the two joint replacements.

Surgeons' fees tended to be higher in those markets with higher per capita income, as expected, due to greater demand for surgery. Again, the two exceptions were the joint replacements. The relationship between per capita income and allowed charges for hip replacements was negative; and for knee replacements, statistically not significant.

The percent of the population who were white was used as a proxy for several factors, including education, income, employment, and private insurance, some of which were treated separately in the regressions. For six of the eight procedures, the relationship with surgeons' allowed charges was negative, meaning that fees tended to be higher where there were relatively <u>fewer</u> whites, after controlling for all other factors included in the equations. Only CABG surgeries and thromobendartarectomy showed the expected positive relationship.

One conclusion to be drawn from these results was that the dynamics of the markets for joint replacements differed from those for the other procedures. Not only was a smaller proportion of the variance explained (note, the R-squares at the bottom of Table 6-7), but the signs of the regression coefficients were often opposite to those of most other procedures. Were orthopedists able to be more independent than other surgeons? Was the demand for these procedures influenced by the surgeons to a larger extent than that for the others? Were the procedures newer than the other procedures and therefore still reflecting start-up conditions that would erode as time passed? We do not know, but this is an area worth further exploration.

7.0 SIMULATION OF IMPACT OF PAYMENT REDUCTIONS FOR "OVERPRICED" PROCEDURES

7.1 Introduction

As part of the Budget Reconciliation Act of 1987, Congress acted to reduce Medicare payments for eleven specific types of surgical procedures: total hip replacement, knee arthroplasty, knee arthroscopy, bronchoscopy, permanent pacemaker insertion, CABG surgery, upper GI endoscopy, transurethral and suprapubic prostatectomy, dilation and curettage, carpal tunnel release, and cataract surgery. These procedures had been identified by the Physician Payment Review Commission as "overpriced", i.e., Medicare was paying substantially more for these procedures relative to other insurors and relative to the physician effort involved (PPRC, 1988).

A relatively complex formula was devised to reduce Medicare prevailing charges for these procedures in such a way as to "roll-back" payments disproportionately more in high fee areas. Briefly, the formula worked as follows:

(1) A "floor" below which no prevailing charge was allowed to fall was set at 85 percent of the national average prevailing charge for the procedure. Table 7-1 displays the mean prevailing charge and the respective 85th percentile for three procedures: total hip replacement, pacemaker insertion, and CABG surgery. If 1987 prevailing charge levels were already at or below this 85 percent level, no further reductions were made. If any of the roll-back provisions described in steps 2-4 would cause the prevailing charge to fall below this level, then no further reductions were made; the new prevailing charge was then set at the 85 percent level.

(2) Prevailing charges for the "overpriced" procedures did not receive the 1988 MEI update; instead, 1987 charge levels were reduced by 2 percent.

(3) The prevailing charge was then divided by the national average prevailing for that procedure. The resulting ratio was then used to find the appropriate sliding scale reduction factor, as shown on Table 7-2. The greater the area prevailing charge relative to the national average, the larger the resulting reduction would be.

(4) The prevailing charge was then multiplied by this sliding scale reduction factor to obtain the new 1988 prevailing charge for participating physicians. As can be seen from Table 7-2, the maximum possible reduction (beyond the initial 2%) is 15 percent. Thus, prevailing charges double the national average would not be reduced any more <u>in percent terms</u> than a prevailing charge that was 50 percent greater than the national average.

(5) Step 4 produced the new 1988 prevailing charges for participating physicians only. This charge was then multiplied by .955 to obtain the prevailing charge limit for nonparticipating physicians.

TABLE 7-1

NATIONAL AVERAGE 1987 PREVAILING CHARGES AND FLOORS FOR OVERPRICED PROCEDURE ROLL-BACKS

Procedure	Code	National Average Prevailing Charge	85% of Average Prevailing ("Floor")
Total Hip Replacement:			
Simple	27130	$2,672	$2,271
Complex	27131	2,718	2,310
Pacemaker Insertion:			
Atrial	33206	1,188	1,010
Ventricular	33207	1,190	1,012
AV Sequential	33208	1,542	1,311
Coronary Artery Bypass Graft:			
One Graft	33510	3,524	2,995
Two Grafts	33511	4,050	3,443
Three Grafts	33512	4,406	3,745
Four Grafts	33513	4,676	3,974
Five Grafts	33514	4,638	3,943
Six+ Grafts	33516	4,889	4,156

Source: HCFA instructions to carriers, 1988.

TABLE 7-2

SLIDING SCALE REDUCTION FACTORS FOR OVERPRICED PROCEDURE ROLL-BACKS

Ratio of Area to National Prevailing	Sliding Scale Reduction Factor	Ratio of Area to National Prevailing	Sliding Scale Reduction Factor
0.86	0.9977	1.19	0.9215
0.87	0.9954	1.20	0.9192
0.88	0.9931	1.21	0.9169
0.89	0.9908	1.22	0.9146
0.90	0.9885	1.23	0.9123
0.91	0.9862	1.24	0.9100
0.92	0.9838	1.25	0.9077
0.93	0.9815	1.26	0.9054
0.94	0.9792	1.27	0.9031
0.95	0.9769	1.28	0.9008
0.96	0.9746	1.29	0.8985
0.97	0.9723	1.30	0.8962
0.98	0.9700	1.31	0.8938
0.99	0.9677	1.32	0.8915
1.00	0.9654	1.33	0.8892
1.01	0.9631	1.34	0.8869
1.02	0.9608	1.35	0.8846
1.03	0.9585	1.36	0.8823
1.04	0.9562	1.37	0.8800
1.05	0.9538	1.38	0.8777
1.06	0.9515	1.39	0.8754
1.07	0.9492	1.40	0.8731
1.08	0.9469	1.41	0.8708
1.09	0.9446	1.42	0.8685
1.10	0.9423	1.43	0.8662
1.11	0.9400	1.44	0.8638
1.12	0.9377	1.45	0.8615
1.13	0.9354	1.46	0.8592
1.14	0.9331	1.47	0.8569
1.15	0.9308	1.48	0.8546
1.16	0.9285	1.49	0.8523
1.17	0.9262	1.50	0.8500
1.18	0.9238	OVER 1.50	0.8500

Source: HCFA instructions to carriers, 1988.

Unlike across-the-board reductions, these roll-backs were designed to squeeze physicans in high fee areas more, while affording some protection for physicians in low fee areas. No information is yet available as to the potential impact of these reductions on physicians. For example:

- How often are allowed charges in an area actually constrained by the new prevailing limits?
- What is the actual dollar amount of the roll-backs? What does this represent as a percent reduction of the surgeon's 1987 allowed charge?
- Do surgeons in some market areas seem to be affected disproportionately more than those in others? What is the average reduction rate for participating physicians versus nonparticipants?
- The sliding scale reductions ignored geographic practice cost differences. What inequities may have been introduced as a result? Have surgeons in high cost-of-practice areas been disproportionately penalized? Conversely, have surgeons practising in low cost areas enjoyed minimal reductions, even though their fees may be high in real terms?

In this chapter, we seek to address these questions by simulating the impact of these roll-backs for three groups of surgical procedures: total hip replacement, pacemaker insertion, and CABG surgery.*

7.2 Simulation Methods

Our objective was to simulate the impact of the overpriced procedure reductions, where we defined the impact as the difference between the new 1988 allowed charge and what surgeons had been receiving in 1987. Thus,

$$\text{Diff}_j = AC_{88} - AC_{87}$$

where

Diff = reimbursement difference for the j-th procedure

$AC_{88,87}$ = allowed charge in 1988 and 1987, respectively.

Because the absolute dollar size of the reduction will vary not only as a function of the sliding scale factor, but also of the size of the charge to start with, we also calculate a percent reduction:

$$\text{PCTDIFF}_j = \text{DIFF}/AC_{87}$$

*Another overpriced procedure subject to the roll-backs was knee arthroplasty, which includes total knee replacement. This was one of the procedures analyzed in Chapter 4 and a potential candidate for inclusion here. However, locality data on 1987 prevailing charges for knee replacement were not available to us.

Our simulations involved a three-step process. First, we had to calculate the new reduced 1988 prevailing charges by procedure code for each locality-specialty combination in our ten state data base. Second, we had to proxy the actual allowed charge for 1988 (AC_{88}). Finally, we subtracted AC_{88} from the 1987 allowed charge (AC_{87}) to compute the size of the reduction (DIFF). This process was performed twice, first with nominal charges, and then with all charges first deflated by the GPCI.

The first step, the calculation of the reduced 1988 prevailing charge screens, required that we obtain the actual 1987 prevailings for all of the reasonable charge localities in our ten states. These data were available from a special survey of carriers conducted by HCFA's Bureau of Eligibility, Reimbursement, and Coverage (BERC). This survey obtained 1987 prevailing charges by locality and specialty for a number of services, including many of the "overpriced" procedures. In fact, many of the national average prevailing charges shown in Table 7-1 were calculated from this survey.

This survey provided most of the 1987 prevailing charges for our simulations. We found, however, that charge data were missing for some procedure-locality combinations. If relatively few cases were affected, we interpolated using comparable charge data, e.g., from another specialty performing the same procedure in the same locality, etc. In other instances, we went directly to the carrier. (No data had been reported on the survey for CABG surgery in New Jersey, for example.)

For the second step, we needed to determine actual allowed charges for 1988. Because some surgeons are reimbursed based on actual or customary charges which fall below the prevailing charge, the 1988 prevailing charges will not always represent actual payments to surgeons in 1988. Actual 1988 allowed charges were assumed to be the 1988 prevailing or the 1987 allowed charge, whichever was less. This assumes no increase during 1987-88 in actual and/or customary charges for surgeons whose 1987 allowed charges were below the 1988 prevailing screen. (All other surgeons are constrained by the new reduced 1988 prevailing charge.) The effect of this assumption is to underestimate 1988 actual allowed charges for some surgeons, but leaves the reduction itself, DIFF, unchanged. This happens because AC_{88} can never exceed the prevailing charge and DIFF can never be greater than zero.

Unfortunately, 1987 allowed charges were not available at the time of this analysis. Instead, we used our 1986 allowed charge data, multiplying them by 3.2 percent, the size of the 1987 MEI update. This introduces some amount of error for physicians whose customary charges were below the 1986 prevailing screen, as their allowed charges could have risen either more or less than 3.2 percent.

In order to test the sensitivity of our 3.2 percent increase in allowed charges, we re-calculated AC_{87} using two alternative updates: 2 percent and 4 percent, respectively. The results were fairly insensitive to these alternative updates, except that DIFF became somewhat larger (in absolute

terms) when the higher update factor was used. More important, relative differences in the size of the reduction across market areas did not change. It is possible, however, that the updates in allowed charges were not uniform across physicians. In particular, nonparticipating physicians, whose submitted charges had been frozen through the end of 1986 and then further constrained by the MAACs in 1987, may not have able to increase their allowed charges at the same rate as participants. To test the sensitivity of our simulations to this assumption, we re-calculated AC_{87} as 2 percent for nonparticipants and 3.2 percent for participating physicians. There were no appreciable differences in our results; this was not too surprising as the nonparticipants were also held to a lower 1988 prevailing charge to start with.

Finally, we assumed that the physician's participation status in 1986 held for 1988 as well. This should not introduce much error, as panel survey data have shown little change in physicians' participation status from October 1984 through the January 1987 decision (Rosenbach et al., 1988).

7.3 Simulation Results

7.3.1 Simulated Roll-Backs in Hip Replacement Charges

Table 7-3 presents our simulated reductions in allowed charges for total hip replacement resulting from OBRA-87. The first column is the absolute dollar amount of the reduction (DIFF) for the average procedure, while the second column expresses the reduction in percentage terms, i.e., DIFF divided by the surgeon's 1987 allowed charge. The third column represents the percent of cases in which the allowed charge was reduced at all, i.e., where DIFF was less than zero. The next three columns present the identical information, except here all prevailing and allowed charge data were first adjusted by the Geographic Practice Cost Index before the roll-back formula was applied.

Based on our simulations, the average allowed charge for a hip replacement would be reduced by 2.7 percent, or \$69. There would be a considerable range in the magnitude of the roll-backs, however, from zero (there were no reductions in over 28 percent of operations) to \$2,000, a reduction of 50 percent. Most reductions, when they occurred, appear relatively small; only 2.5 percent of operations would be reimbursed ten percent or more less than they were in 1987.

Considerable variation exists, however, in the distribution of the roll-backs across market areas. Hip replacements in Phoenix, Hartford, and Newark would be reduced by over 4 percent on average, while those in Oklahoma City and Seattle would receive minimal reductions, if any.

The roll-back formula implemented by Congress made no adjustments for the fact that higher fees in a given area may simply reflect higher costs of physician practice. If the formula were applied after first adjusting for practice cost differences, the actual reduction would be somewhat higher on average: \$89, or 3.5 percent of 1987 allowed charges, versus \$69 and 2.7

TABLE 7-3

SIMULATED OBRA-87 REDUCTIONS IN ALLOWED CHARGES FOR TOTAL HIP REPLACEMENT

	Unadjusted			GPCI-Adjusted		
	Mean Dollar Reduction	Percent of Allowed Charge	Percent of Cases With Any Reduction	Mean Dollar Reduction[a]	Percent of Allowed Charge	Percent of Cases With Any Reduction
Birmingham, AL	$-88	-3.1%	59.9%	$-107	-3.7%	63.2%
Phoenix, AZ	-105	-4.1	86.0	-184	-7.3	83.7
Hartford, CT	-121	-4.5	89.6	-16	-0.5	33.6
Atlanta, GA	-71	-2.9	74.6	-100	-4.1	79.3
Kansas City, KA	-32	-1.1	61.8	-60	-2.3	62.5
Newark, NJ	-109	-4.2	83.4	-4	-0.1	49.3
Oklahoma City, OK	-9	-0.4	80.1	-58	-2.7	80.8
Portland, OR	-52	-2.3	94.2	-39	-1.8	89.7
Seattle, WA	-22	-0.9	81.6	-19	-0.7	46.2
Milwaukee, WI	-27	-1.0	53.8	-20	-0.7	46.2
All Market Areas	-69	-2.7	71.4	-89	-3.5	62.7

[a]These figures have been converted back to nominal dollars, in order to be directly comparable with the unadjusted dollar reductions.

Source: Medicare Part B Claims, 1986.

percent. More importantly, the burden of the overpriced procedure roll-backs would be shifted to surgeons practising in different market areas. The large reductions in Hartford and Newark would be almost eliminated, for example. By contrast, average reimbursements for hip replacement would receive somewhat larger cuts in Birmingham, Phoenix, Atlanta, Kansas City, and Oklahoma City.

7.3.2 Simulated Roll-Backs for CABG Surgery Charges

The OBRA-87 reductions would appear to have a disproportionately larger impact on charges for CABG surgery (see Table 7-4). Payment for the average operation would be lowered by $198, or 4 percent below 1987 levels. However, fewer than one-half (43.1%) would receive any cut whatsoever, implying that when reductions are imposed they are considerably larger, i.e., 9 percent.

From Table 7-4, moreover, we see that the ten-state wide average has been highly skewed by the roll-backs imposed in Newark (and in other parts of New Jersey not shown here). The average charge for a CABG operation would be reduced by more than 22 percent, or $1,295. Although New Jersey is a very expensive state, we can see from the GPCI-adjusted simulations that the reductions are still exceedingly large after we adjust for practice cost differences. We discovered that prior to 1987 the New Jersey carrier had been reimbursing CABG surgery on the basis of relative value units, rather than customary and prevailing charge screens. In 1987, the carrier developed state-wide prevailing charges for CABG surgery that were substantially below previous reimbursement levels. The average prevailing charge in 1987 was 12 percent below the average allowed charge in Newark in 1986, for example; when the OBRA-76 roll-backs are then imposed on top of this, the result is a disproportionately large cut relative to 1987 allowed charges. (Recall that our 1987 allowed charges were a simple 3.4 percent increase over 1986 levels.)

If prevailing charges were first adjusted for geographic practice cost differences, the relative magnitudes of the reductions would shift, but not by nearly as much as they did for hip replacement. Surgeons practising in Newark and Seattle, for example, would have experienced somewhat smaller roll-backs in their CABG fees, while their Oklahoma City colleagues would have received larger cuts, but the dollars involved are relatively small (especially when compared with the CABG fee itself). Surgeons operating in Birmingham and Kansas City remain virtually unaffected, regardless of whether or not the practice cost adjustment is made.

7.3.3 Simulated Roll-Backs for Pacemaker Insertion Charges

Our simulations suggest that charges would be reduced in fewer than one-half (46%) of pacemaker insertion cases (see Table 7-5). The roll-backs range from virtually zero in Oklahoma City and Milwaukee to 4.5 percent in Newark. If the reductions had been calculated on practice cost-adjusted

TABLE 7-4

SIMULATED OBRA-87 REDUCTIONS IN ALLOWED CHARGES FOR CABG SURGERY

	Unadjusted			GPCI-Adjusted		
	Mean Dollar Reduction	Percent of Allowed Charge	Percent of Cases With Any Reduction	Mean Dollar Reduction[a]	Percent of Allowed Charge	Percent of Cases With Any Reduction
Birmingham, AL	$-21	-0.5%	11.8%	$-27	-0.7%	17.8%
Phoenix, AZ	-50	-1.2	23.6	-40	-0.9	22.0
Hartford, CT	-115	-2.4	31.5	-89	-1.8	29.2
Atlanta, GA	-189	-4.8	56.8	-190	-4.8	56.8
Kansas City, KA	-16	-0.4	12.8	-22	-0.6	14.8
Newark, NJ	-1,295	-22.2	97.3	-1,074	-18.3	96.7
Oklahoma City, OK	-122	-3.1	85.4	-190	-4.9	90.7
Portland, OR	-99	-2.2	54.7	-93	-2.1	54.7
Seattle, WA	-218	-4.8	68.1	-107	-2.4	55.7
Milwaukee, WI	-166	-3.7	53.1	-127	-2.8	44.6
All Market Areas	-198	-4.0	43.1	-185	-3.8	43.1

[a]These figures have been converted back to nominal dollars, in order to be directly comparable with the unadjusted dollar reductions.

Source: Medicare Part B Claims, 1986.

TABLE 7-5

SIMULATED OBRA-87 REDUCTIONS IN ALLOWED CHARGES FOR PACEMAKER INSERTION

	Unadjusted			GPCI-Adjusted		
	Mean Dollar Reduction	Percent of Allowed Charge	Percent of Cases With Any Reduction	Mean Dollar Reduction[a]	Percent of Allowed Charge	Percent of Cases With Any Reduction
Birmingham, AL	$-12	-1.1%	42.2%	$-15	-1.3%	48.0%
Phoenix, AZ	-35	-2.7	55.1	-28	-2.1	47.3
Hartford, CT	-18	-1.6	38.6	-3	-0.3	12.9
Atlanta, GA	-24	-1.9	60.4	-38	-3.0	69.5
Kansas City, KA	-22	-1.7	21.1	-27	-2.0	41.2
Newark, NJ	-69	-4.5	67.0	-19	-1.2	35.4
Oklahoma City, OK	-8	-0.7	12.0	-11	-0.9	12.4
Portland, OR	-25	-3.5	31.9	-25	-3.5	31.9
Seattle, WA	-18	-1.6	20.6	-12	-1.0	15.4
Milwaukee, WI	-5	-0.6	19.5	-2	-0.2	9.3
All Market Areas	-39	-2.9	46.3	-40	-3.2	43.2

[a]These figures have been converted back to nominal dollars, in order to be directly comparable with the unadjusted dollar reductions.

Source: Medicare Part B Claims, 1986.

prevailing charges, the burden of the roll-backs would have been shifted to physicians practising in other market areas. The average cut of $69 in Newark would shrink to $19, while reductions in Atlanta would increase (in absolute value).

There is reason to believe, however, that there are additional inequities in how the pacemaker roll-backs have been implemented. Physicians inserting pacemakers in Milwaukee would receive small, if any, reductions in their average reimbursement. But we know from Chapter 3 that a single bill does not adequately represent the "true" charge when a team approach is employed for pacemaker insertion. This team approach was used in two-thirds of all insertions in Milwaukee; the total cost of the insertion was 38 percent higher in these cases than if a single physician had performed the entire procedure. Thus, the use of the team approach in Milwaukee (as well as other cities in Wisconsin and elsewhere) permits those physicians to avoid the overpriced procedure roll-back for pacemakers.

7.3.4 State and Urban-Rural Impacts

Because the simulated reductions in the previous tables were presented for the largest MSA in each of our states, they may have understated the extent to which the roll-back burden would shift after practice cost adjustment. There is undoubtedly more variation in practice costs when we include other MSAs and rural areas. Table 7-6 presents simulated impacts at the state, and urban-rural level, for all three procedures, first using the Congressionally mandated formula and then making a practice cost adjustment. The percentages represent the percent of cases in which the reduction was 5 percent or more of the 1987 allowed charge.

It is clear from Table 7-6 that a practice cost adjustment to the roll-back formula would greatly alter the relative distribution of the reductions. Simulated payments for hip replacements were reduced at least 5 percent in fewer than ten percent of all Georgia cases, for example. If the practice cost adjustment had been applied, however, more than half (55%) of those cases would have experienced roll-backs of 5 percent or more.*

The use of a practice cost adjustment would have increased the number of cases with reductions of at least 5 percent in Alabama, Connecticut, and Kansas (pacemakers only in these states), Georgia (hip replacement and pacemaker), Oklahoma (all procedures), Oregon (hip replacment only), Washington (hip replacement and pacemaker), and Wisconsin (hip replacement only). The percent of cases with reductions of this size would have fallen in other instances, however: Arizona and New Jersey (hip replacement and pacemaker in both states), Connecticut (hip replacement only), and Washington (CABG surgery only).

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*By contrast, comparable figures for Atlanta alone were 0.4 and 15 percent, respectively.

TABLE 7-6

PERCENT OF CASES WITH SIMULATED CHARGE REDUCTION OF FIVE PERCENT OR MORE

	Hip Replacement		CABG Surgery		Pacemaker Insertion	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Alabama	41.2%	43.5%	5.5%	5.5%	12.9%	29.4%
Arizona	54.0	13.0	7.9	7.5	24.2	15.0
Connecticut	44.1	37.9	49.0	47.7	9.4	30.5
Georgia	8.4	55.3	16.7	18.3	12.4	33.9
Kansas	2.5	6.2	3.4	6.6	6.4	28.2
New Jersey	56.3	7.7	84.9	84.7	45.9	29.9
Oklahoma	0.2	4.0	12.8	33.2	12.7	16.3
Oregon	0.6	30.5	6.0	6.0	42.9	43.6
Washington	3.3	13.0	38.1	21.6	10.8	15.1
Wisconsin	12.1	28.1	20.0	18.6	3.2	2.0
All Urban Areas	25.0	20.3	25.8	25.5	21.8	23.0
All Rural Areas	15.0	42.1	--	--	20.6	46.0
All Markets	23.8	22.9	25.8	25.5	21.6	25.9

Source: Medicare Part B Claims, 1986.

Although surgeons in rural areas often (but not always) charge lower fees than their urban colleagues in the same state, their fees are not nearly as low as would have been expected given their areas' considerably lower practice costs. We saw earlier in Chapters 3-5 that practice cost adjustment often made rural surgeons among the best paid on a per operation basis. As a result, incorporation of practice costs in the roll-back formula would greatly increase the charge reductions in rural areas. As seen in Table 7-6, one-sixth of hip replacements and one-fifth of pacemaker insertions performed by rural surgeons have simulated reductions of five percent or more. After practice cost adjustment, however, these figures would more than double to 42 and 46 percent, respectively, for hip replacement and pacemaker surgery.

Thus, an unexpected effect of a presumably equity-enhancing policy (i.e., the practice cost adjustment) would be to shift the burden of the overpriced procedure roll-backs from urban to rural physicians. Whether or not this is appropriate depends in large part on the reliability of our measure of practice costs. As discussed in Chapter 2, the index is preliminary and is being refined using a larger Census sample which will permit an adjustment for area differences in occupational mix; this may particularly affect index values for small MSAs and rural areas (where there are relatively fewer highly trained, highly paid professionals). While policymakers may be reluctant to adopt a policy which appears to "penalize" rural surgeons, it should be noted that the operation itself may be performed in an urban area, particularly in the case of "high technology" surgery like hip replacment. The rural designation is based on the location of the surgeon's office practice, not the hospital.

7.3.5 Relative Impacts on Participating and Nonparticipating Physicians

The Congressional overpriced procedure roll-back formula explicitly provided that nonparticipating physicians should bear a relatively larger share of the reduction. By setting their prevailing charge at 95.5 percent of that for participants, Congress ensured that nonparticipants would face potentially larger reductions, all other things being equal. Table 7-7 presents the percent of cases treated by participating and nonparticipating physicians in each of three groups: (1) cases in which the charge was not reduced at all; (2) cases in which the charge was reduced, but the reduction represented less than 5 percent of the 1987 allowed charge; and (3) cases in which the reduction was 5 percent or more.

Based on our simulations, Congress appears to have been successful in rolling-back charges disproportionately for nonparticipating surgeons. In the case of both hip replacement and pacemaker insertion, participating surgeons would be less likely to experience large charge reductions or to incur any reductions at all, compared with nonparticipants. The relative impacts are

TABLE 7-7

SIMULATED ROLL-BACKS FOR PARTICIPATING AND NON-PARTICIPATING PHYSICIANS[a]

	Size of Percent Reduction[b]		
	None	Small	Large
Hip Replacement			
Participants	43.8%	44.9%	11.3%
Non-Participants	24.0	48.5	27.5
CABG Surgery			
Participants	60.4	13.3	26.3
Non-Participants	53.4	21.4	25.2
Pacemaker Insertion			
Participants	58.5	26.7	14.8
Non-Participants	50.9	23.4	25.7

[a]Rows sum to 100 percent.

[b]Small reductions are those greater than zero but less than 5 percent (in absolute value). Large reductions are defined as 5 percent or more.

Source: Medicare Part B Claims, 1986.

less dramatic in the case of CABG surgery. While participating thoracic surgeons <u>are</u> less likely to incur any charge reductions compared with their nonparticipating colleagues, both groups would have equal proportions of cases with large reductions. Upon examination, this latter phenomenon turned out to be solely an artifact of the unrelated across-the-board prevailing charge reductions made for <u>all</u> New Jersey surgeons (as described in Section 7.3.2).

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